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PESTICIDES ABSTRACTS (formerly Health Aspects of Pesticides Abstract Bulletin) is a monthly publication of the Technical Services Division of the Office of Pesticide Programs, Environmental Protection Agency.

The purpose of this publication is to foster current awareness of the major worldwide literature pertaining to the effects of pesticides as defined in the Table of Contents. The publication represents a monthly review of more than 2,000 primary and secondary sources. A list of periodicals from which articles have been abstracted appears annually in the January issue. Subjects and authors of abstracted articles are cross-referenced in quarterly and annual indexes. Reprint requests should be directed to the author of the complete article.

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76-2615. Biever, K. D.; Ignoffo, C. M.; Hostetter, D. (Biol. Contr. Insects Lab., USDA, N. Cent. Reg., Univ. Missouri Res. Park, Columbia, MO). **Living insecticides.** *Chem. Technol.* 5(7): 396-401; 1975. (44 references)

More selective methods of pest control are being considered as alternatives to chemical pesticides. Some of these methods involve agents which induce disease in insects. Among these agents are bacterial entomopathogens, entomopathogenic viruses, entomopathogenic fungi, and entomopathogenic protozoans. Several species of parasitic nematodes also show promise as biological control agents against, for example, mosquito larvae. There also are larvivorous fish which feed on mosquito larvae, and there are invertebrate predators as well. Genetic manipulation can be used to advantage in controlling insect pests. Plants, under certain conditions, may also prevent breeding by certain insects. Insect growth regulators, i.e., chemicals which regulate the growth, molting, and general development of insects, are being researched. The juvenile hormone is of particular interest. Such chemicals are used in much the same way as the standard insecticides, but they are not conventional toxicants as they only interfere with insect larval and pupal development and metamorphosis.

76-2616. Kryshanovskaya, M. V.; Sova, R. E. (Author address not given). **Plenum problemnoy komissii "Nauchnye osnovy gigiyeny i toksikologii pestitsidov, polimerov i plasticheskikh mass." [Plenary session of the commission on problems of "Scientific bases of hygiene and toxicology of pesticides, polymers, and plastics."]** *Gig. Sanit.* 41(2): 116-117; 1976. (Russian)

Past achievements and plans for future studies in the hygiene, toxicology, and clinical aspects of pesticides, polymers, and plastics were discussed at the plenary session held on Feb. 20-21, 1975. The effect of pesticides, polymers, and plastics on the environment and on humans; mathematical studies on hygienic standards for the use of pesticides, polymers, and plastics in agriculture, industry (construction, clothing), and research (blastomogenic, embryotoxic, and teratogenic effects); criteria for evaluating long-term effects of pesticides, polymers, and plastics; and the diagnosis of chemical intoxication were among the topics reviewed. The need for increased efforts in biological control of pests using endocrine, hormonal, and other preparations; studies on allergenic effects of chemicals; and new pest control methods were emphasized. The presence of pesticides at various concentrations in different components of our environment is reviewed, with emphasis on the effects of pesticides on the biosphere and the mechanisms of their action. Any substance toxic to pests can be classified as a pesticide. Pesticides are intentionally released into the environment for agricultural and public health purposes. They become environmental pollutants when transferred outside the area of deliberate application or if they remain in the environment longer than necessary. Pesticides are transported by various means from place to place after dispersal. Pesticides are present in air, water, and soil, and enter food chains. Pesticide residues are absorbed by crops. These chemicals affect soil microorganisms, plants, birds, insects, and mammals.

76-2617. Bokil, S. D.; Iyengar, L. (Dept. Civil Engineering, Indian Inst. Technol., Kanpur, India). **Pesticides in the environment.** *J. Sci. Ind. Res.* 34(11): 625-631; 1975. (47 references)

The presence of pesticides at various concentrations in different components of our environment is reviewed, with emphasis on the effects of pesticides on the biosphere and the mechanisms of their action. Any substance toxic to pests can be classified as a pesticide. Pesticides are intentionally released into the environment for agricultural and public health purposes. They become environmental pollutants when transferred outside the area of deliberate application or if they remain in the environment longer than necessary. Pesticides are transported by various means from place to place after dispersal. Pesticides are present in air, water, and soil, and enter food chains. Pesticide residues are absorbed by crops. These chemicals affect soil microorganisms, plants, birds, insects, and mammals.

76-2618. Ouw, K. H. (Health Commission New South Wales, Div. Occup. Health Radiat. Contr., Lidcombe, New South Wales, Australia 2141). **HCB as a cereal seed dressing discontinued in Australia.** *Med. J. Aust.* 1(8): 255; 1975.

In this letter to the editor it is noted that at the request of the Australian Agricultural Council, the use of hexachlorobenzene as a cereal seed dressing has been discontinued in Australia. In its place, mancozeb, carboxin, and fenaminosulf have been developed as cereal seed dressings. In reference to a previously printed paper (*Pesticides Abstracts* No. 75-1316) it is noted that the mean blood DDT level of 21.9 ppb was found in the group exposed to a range of 0 to 70 ppb and not 0 to 07 ppb DDT as reported.

76-2619. Jackson, T. C. (Author address not given). **PCB time bomb.** *Oceans* 9(4): 58-63; 1976.

PCB contamination in wildlife and man is usually found in the ppm range. However, through the process of bioaccumulation, PCBs are concentrated in animal tissues at levels up to 40,000 times greater than those in the surrounding environment. The contaminant also settles to the bottom of ponds, streams, or harbors, where it is bascially

insoluble in the water but is able to enter small marine life. Stillbirths, miscarriages, visual impairment, skin disease, neurological disorders, hearing loss, discharge of a cheese-like substance from the eyes, swelling of the eyelids, and systemic gastrointestinal symptoms with jaundice were the primary symptoms in Japanese victims exposed to PCB as a contaminant in rice oil which they consumed. Occupational exposure studies have revealed additional hazards from this contaminant. In some people symptoms have persisted for up to three years after PCB exposure was stopped. PCB pollution has already closed a $1.25 million commercial striped bass fishery in the Hudson and endangered an even larger sphere of sport fishing. Incineration at temperatures exceeding 2,400°F is the only known disposal method for this toxic substance.

76-2620. Anonymous. **Common names of pesticides. Revised list—February 1973.** *PANS* 19(2): 287-306; 1973.

The common names of 664 pesticides are listed as supplied by various authorities. The authorities consulted include the British Standards Institution, Canadian Standards Association, Entomological Society of America, International Organization for Standardization, USA Standards Institute, and Weed Science Society of America. The various pesticides listed fall into the classifications of: acaricides, fungicides, herbicides, insecticides, molluscicides, nematicides, plant growth regulators, rodenticides, synergists, avicides, repellents, and bactericides.

76-2621. Dewse, C. D. (Cytogenetics Unit, Nuffield Wing, Sch. Med., Liverpool, England). **Dangers of T.C.D.D.** *Lancet* 2(7981): 363; 1976. (8 references)

In this letter to the editor it is suggested that the facts concerning the teratogenic and perhaps carcinogenic properties of TCDD (dioxin) be more widely made known and considered. TCDD is produced as a contaminant in the commercial production of trichlorophenol. It is suggested that the effects should be known in the event of the occurrence of an accident at the manufacturing plant. Reference is made to the dioxin released into the environment following an accident at a 2,4,5-T manufacturing plant is Seveso, Italy.

76-2622. Levins, R. (Dep. Biol., Univ. Chicago, Chicago, IL 60637). **The qualitative analysis of partially specified systems.** *Ann. N.Y. Acad. Sci.* 231: 123-138; 1974. (8 references)

The problems faced in ecology studies are complex, and systems built on one-step linear causality are poor predictors of the ultimate outcome. Ways of approaching such complex systems qualitatively by examining network properties of the wholes rather than sections of the problem are discussed. In partially specified systems this procedure may be the only one available. Conditions necessary for understanding the local stability of a system are reviewed. Some systems may appear to be at equilibrium and yet change. This occurs when the parameters of a system seem to be constant and in fact change slowly, thus creating a moving equilibrium level. Finally, various evolutionary processes exist, causing different systems to evolve very differently. Approaching such studies as wholes allows an increased understanding of what is taking place and indeed helps to determine what factors should be measured. This emphasis on the holistic and qualitative side of scientific examinations is intended as a corrective factor for the one-sided analytical quantitative approach which is still dominant in the thinking of analysts, and not as a replacement for it.

76-2623. Dedek, W.; Partisch, M. (Forschungsst. Chem. Toxikol. Akad. Wiss., Leipzig, DDR). **Studien zum Rueckstandsverhalten und Abbau von P-markiertem Trakephon in Pflanzen. [Studies on residue dynamics and degradation of P-labeled Trakephon in plants.]** *Biochem. Physiol. Pflanz.* 169(4): 399-402; 1976. (2 references) (German)

A new defoliant and desiccant, Trakephon, was applied in field experiments to potatoes, clover, and alfalfa. Translocation in the plants was observed and metabolites were formed rapidly. No translocation was observed in the soil. The residues in clover and alfalfa seed ranged from 2 to 20 ppm. In potatoes the residue was 0.003 to 0.036 ppm, based on ^{32}P, without regard to any metabolites which may have been present. The degradation and half-life in buffer solutions were measured at 20 and 40°C between pH 2 and 11. In water the solubility was determined to be 170 ppm.

76-2624. Pauws, A. G.; Canton, J. H. (Natl. Inst. Public Health, Bilthoven, The Netherlands). **Adsorption of thallium ions by Prussian Blue.** *Bull. Environ. Contam. Toxicol.* 15(3): 335; 1976. (5 references)

Studies have suggested that thallium discharged into surface water may present a danger to aquatic life. In this content it is noted that the insoluble inorganic pigment Prussian Blue adsorbs thallium ions almost quantitatively. It works by exchanging potassium ions from the crystal surface against thallium ions. It is not toxic; it is produced on a technical scale, and may be useful in a granulated form in a percolation bed or as a sludge in basins to purify thallium containing waste water prior to discharge.

76-2625. Mauck, W. L.; Mayer, F. L., Jr.; Holz, D. D. (Fish-Pestic. Res. Unit, La Crosse, WI 54601). **Simazine residue dynamics in small ponds.** *Bull. Environ. Contam. Toxicol.* 16(1): 1-8; 1976. (10 references)

Four physically and biologically similar 0.1-ha ponds were treated twice with simazine (application concentration 0.5-2.5 μ/ml) to give estimated pesticide concentrations of 0.1, 0.3, 1.0, and 3.0 μg/ml in the four ponds, respectively; a fifth pond was maintained as a control. Herbicide residues in samples of mud, water, benthic invertebrates, and fish (*Lepomis macrochirus*) were determined by alkali flame ionization gas-liquid chromatography. Bioaccumulation of simazine was evident only in the invertebrates for the first 86 days after treatment, although some simazine was present in the fish and invertebrates for at least 1 yr. In general, the residue levels in the water and biota were similar to or less than treatment concentrations. Residues in the fish generally did not exceed those in the water from which the fish were taken. The amount of pesticide in the mud was directly related to the application rates and residues were detectable in all samples 456 days after the second application. Simazine offers excellent potential for aquatic vegetation control in fishery management.

76-2626. Kutz, F. W.; Sovocool, G. W.; Strassman, S.; Lewis, R. G. (Ecol. Monitoring Br. (WH-569), U.S. Environ. Protect. Ag., Washington, DC 20460). ***Trans*-nonachlor residues in human adipose tissues.** *Bull. Environ. Contam. Toxicol.* 16(1): 9-14; 1976. (10 references)

Human adipose tissue specimens collected at various geographic locations throughout the conterminous United States were analyzed for organochlorine pesticides using electron capture gas-liquid chromatography and mass spectrometry. Of the nine composite samples analyzed from nine different census divisions within the Country, eight showed confirmable *trans*-nonachlor at levels greater than 0.01 ppm. Positive samples were found in widely diverse geographic areas as well as in widely diverse demographic distributions. One composite sample from Ohio did not contain confirmable quantities of *trans*-nonachlor and the composite sample from Utah contained lower levels than the other positive samples. The reasons for these findings were not determined.

76-2627. El Zorgani, G. A.; Musa, A. (Agric. Res. Corp., Entomol. Sect., Wad Medani, Sudan). **Organochlorine insecticides in the blood of occupationally exposed people in Sudan.** *Bull. Environ. Contam. Toxicol.* 16(1): 15-17; 1976. (9 references)

Blood samples were collected from male personnel exposed to organochlorine insecticides at the Gezira Research Farm in Wad Medani, Sudan. The samples were analyzed for insecticide residues using electron capture

gas chromatography. DDE and *p,p'*-DDT were found in all samples at concentrations of 0.01-0.12 μg/ml and 0.2-1.01 μg/ml, respectively. Dieldrin was found less frequently and at concentrations not exceeding 0.01 μg/ml in most cases. TDE was found in only two of the 22 samples. An unidentified peak which ran slower than *p,p'*-DDT was observed in most samples. Some of the highest pesticide levels were found in subjects with more than 15 yr exposure. Efforts should be made to reduce the residue levels in these and similarly exposed subjects in this region.

76-2628. Mathur, S. P.; Hamilton, H. A.; Greenhalgh, R.; MacMillan, K. A.; Khan, S. U. (Soil Res. Inst., Ottawa, Ontario, Canada). **Effect on microorganisms and persistence of field-applied carbofuran and dyfonate in a humic mesisol.** *Can. J. Soil Sci.* 56(2): 89-96; 1976. (16 references)

Banded and broadcast applications of carbofuran at 4.48 kg a.i. (active ingredient)/ha and a banded application of dyfonate at 2.24 kg a.i./ha were made in field plots on an organic soil on which onions and lettuce were grown. About 60% of the dyfonate initially present and more than 90% of the carbofuran disappeared in 125 days. The differences caused in the size of microbial population by dyfonate was mostly marginal, ambivalent, and transient. However, both carbofuran applications resulted in about 100 to more than 300% increases in bacterial plus actinomycetal populations spanning three samplings over 2 mo. CO_2 evolution was also increased for a longer period by carbofuran additions. The fungal population was altered only sligtly. NO_3-N, NH_4-N, and H_2O-soluble PO_4 levels were not changed substantially due to the insecticide treatments in this organic soil. (Author abstract by permission)

76-2629. Morita, H. (Soil Res. Inst., Ottawa, Ontario, Canada). **Linuron adsorption and the degree of decomposition of peats as measured by rubbed fibre and pyrophosphate index.** *Can. J. Soil Sci.* 56(2): 105-109; 1976. (13 references)

Determination of the Freundlich adsorption isotherms for linuron with some peats showed that the adsorption coefficient, *K*, is closely related to the degree of decomposition as measured by the rubbed fibre content and the pyrophosphate index. The *K* values indicate that adsorption increases with decomposition. The analyses required for the determination of *K* were facilitated by the use of a column extraction technique. (Author abstract by permission)

76-2630. Anonymous. **Process gobbles up chlorinated compounds.** *Chem. Eng. (London)* 83(17): 51-52; 1976.

A catalyzed reduction system is described which removes chlorinated pesticides from effluent streams. The treatments uses a catalyzed-iron reducing agent. Materials amenable to the system's reductive degradation method included: cyclodiene pesticides such as aldrin, dieldrin, and endrin; DDT and related materials, such as TDE and methoxychlor; the chlorinated camphene, toxaphene; the chlorinated cyclohexane, lindane; and the chlorinated phenoxyacetic-acid herbicides, 2,4-D, and 2,4,5-T. The system can also remove chloroform, carbon tetrachloride, and ethylene dichloride. It may also reduce levels of PCBs in effluent streams. The estimated total cost of the system is $0.72/1,000 gals treated.

76-2631. Domanski, J. J., Jr. (North Carolina State Univ., Raleigh, NC). **Residues of some chlorinated hydrocarbon insecticides in tobacco and their relationship to residues in the adipose tissues of cigarette smokers.** *Diss. Abstr. Int. B* 37(2): 549; 1976.

Procedures were developed for analyzing tobacco for residues of DDT, TDE, endosulfan, dieldrin, endrin, and toxaphene and for estimating total residues from single-compound analyses. Results obtained on auction market samples from 1970 and 1972 and on retail market samples from 1971 and 1972 indicated a general decline in residues of DDT, TDE, endrin, and toxaphene in most products, but increasing endosulfan residues. Analyses of tobacco leaf and soil samples from fields with varying histories of use for TDE, DDT, endrin, dieldrin, and toxaphene indicated that tobacco became contaminated with these insecticides by uptake from the soil and movement through air as a drift or vapor. No relationship was demonstrated between smoking habit and adipose tissue levels of DDT and DDE in individuals with known smoking histories. A marginally significant relation was found for the male black group between dieldrin residues and number of cigarettes smoked per day. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 76-17,259).

76-2632. Thomas, E. D.; Heimpel, A. M.; Adams, J. R. (Dep. Entomol., Univ. Maryland, College Park, MD 20742). **Determination of the active nuclear polyhedrosis virus content of untreated cabbages.** *Environ. Entomol.* 3(6): 908-910; 1974. (9 references)

Mature heads of untreated Harris Resistant Danish cabbage and Waltham cabbage were subjected to a bioassay procedure to determine their active nuclear polyhedrosis virus content. The activity of the virus was determined by interpolation of dose-mortality data obtained from bioassays of homogenized wrapper leaves, heads, and whole cabbages. An average of 4.61×10^3 active polyhedra/g of edible head cabbage was obtained from the Harris Resistant Danish cabbages (grown in 1972), average counts of 10.48×10^4 and 2.66×10^4 polyhedra/cm^2 were recorded on the outer and inner head leaves. Only light infestations of cabbage loopers were observed throughout the growing season, and about 88% of the cabbage heads were thus of marketable quality. The edible heads of the Waltham cabbages (grown in 1971) contained an average of 0.73×10^6 polyhedra/g cabbage. The proposed method of virus determination is advantageous in that active virus

is determined, but it has a disadvantage in that virus species cannot be detected.

76-2633. Goncharuk, E. I.; Sokolov, M. S.; Spasov, A. S.; Shostak, L. B. (Kiev Medical Institute, Kiev, USSR). **Primenenie peschanykh kul'tur pri normirovanii khimicheskikh veshchestv v pochve. [The use of sand cultures in establishing standards for chemicals in the soil.]** *Gig. Sanit.* 41(4): 51-54; 1976. (4 references) (Russian)

A mineral complex consisting of a structural skeleton of medium-grained sand and a nutrient mixture was tested as a model soil standard (MSS) for experiments on the migration of chemicals from the soil into plants. The results of a study of Karathane (dinocap) migration into radish plants using the MSS and Pryashnikov's nutrient mixture were closely comparable (95.8%) to results obtained under natural (chernozem) conditions. When Hellriegel's nutrient mixture, imitating podzol-forming soil, was used in the MSS, the results were not as close to those obtained under natural conditions (75.0%). Analogous results were obtained when Knop's nutrient mixture was used. Thus Pryashnikov's nutrient mixture is recommended for the preparation of the MSS as a simplified and accelerated method for establishing maximum permissible concentrations of pesticides in the soil.

76-2634. Zarubin, G. P.; Novikov, Yu. V. (Author address not given). **Bar'yernaya rol' vodoprovodnykh sooruzheniy. [The barrier role of water supply systems.]** *Gig. Sanit.* 41(4): 72-79; 1976. (11 references) (Russian)

Literature on the effectiveness of water supply systems in the removal from water of various organic and inorganic compounds, many of them common industrial pollutants, is reviewed. Evidently the usual methods of water purification, including filtration, ozonization, flocculation, chlorination, coagulation, settling, and UV irradiation, do not ensure the removal of most types of chemical pollutants. The barrier role water supply systems is limited, and in the case of significant pollution of water sources, residual amounts of the pollutants in drinking water may exceed the maximum permissible concentrations. Thus strict observation of established standards for maximum permissible concentrations of industrial pollutants in water bodies used for centralized drinking water supply is necessary.

76-2635. Ubaydullayev, A. Kh. (Uzb. Res. Inst. Sanit., Hyg. Occup. Dis., Tashkent, USSR). **Gigienicheskaya otsenka zagryazneniya vneshney sredy pri obrabotke lesonasazhdeniy metationom. [Hygienic assessment of environmental pollution in treatment of forest plantings with metathion.]** *Gig. Sanit.* 41(4): 101-102; 1976. (Russian)

Levels of metathion (methyl parathion), used in the Uzbek SSR (USSR) for dusting forests were determined based on the P content in samples of air and on airport and cockpit surfaces and skin surfaces of workers. Air in areas where metathion was transferred into containers contained 0.338-0.720 mg/m³, and the air in areas where the airplane was filled, 0.351-0.435 mg/m³. Cockpit air contained 0.162-0.685 mg/m³ metathion. Metathion content on the skin of workers varied from 0.040-0.239 mg/cm² of skin after exposure. Air in the forest treated with metathion contained 0.078-0.261 mg/m³ of the pesticide. Data on the content of metathion in the the soil, water, and plant leaves at 1-4 days after treatment and at a distance of 100-1500 m from the treated area are included. The metathion content began to decrease only on the 4th-5th day after treatment. Water or leaves of plants near treated areas should not be consumed for 8-10 days to prevent the poisoning of humans and animals. Airport personnel and pilots exposed to the pesticide should wear the protective clothing recommended for use with organophosphorus preparations.

76-2636. Revelante, N.; Gilmartin, M. (Cent. Mar. Res., Inst. "Rudger Boskovic," 52210 Rovinj, Yugoslavia). **DDT, related compounds and PCB, in tissues of 19 species of Northern Adriatic commercial fishes.** *Invest. Pesq.* 39(2): 491-507; 1975. (49 references)

A preliminary survey was conducted of selected chlorinated hydrocarbons in 19 species of commercial fish from the Northern Adriatic in an effort to evaluate currently occurring levels of these pollutants and to produce a baseline for future reference. Fish were caught about 15 kilometers off the coast. Data was analyzed on both a wet weight basis and a lipid weight basis. Considering all the species analyzed as a set, the levels of total DDT found were in general average or low compared with similar data reported from other regions. The Adriatic fish did have much higher concentrations than mid-water fish collected in the Gulf of California, an area remote for pesticide application. When compared to related species from other regions the concentrations of DDT-T in Adriatic species were usually lower, even though the Adriatic area is often viewed as heavily polluted. The squid, *Loligo vulgaris*, was an exception to this generalization. None of the fish or tissues analyzed approached or exceeded FDA limits. Pelagic species averaged twice the levels of benthic species, indicating input which occurred at other sites during migrations.

76-2637. Young, R. H.; Jahn, O. L. (U.S. Dep. Agric., Agric. Res. Serv., Orlando, FL). **The fate of 1,2-^{14}C-(2-chloroethyl)phosphonic acid in citrus.** *J. Am. Soc. Hort. Sci.* 100(5): 496-499; 1975. (26 references)

^{14}C-Ethephon was applied to mature, green lemon fruit and the levels and fruit of tangerine, mandarin, and tangelo trees to determine the fate of the product in citrus tissues. The lemon and tangerine fruit treated with ^{14}C-ethephon evolved radioactive ethylene with a high specific activity. The ethephon was probably the major source of ethylene in the fruit, and it appeared that the ethylene evolved was not metabolized to any significant extent by the citrus leaves or fruit. Because no detectable $^{14}CO_2$ was

produced within 14 days of treatment, it was concluded that ethephon C atoms were not metabolized in the usual respiratory cycle. Ethephon was not translocated rapidly throughout the citrus plant, but remained near the site of application. On the first day after postharvest ^{14}C-ethephon treatment a total of 18.3% of the applied activity was recovered from the fruit, 60% from the surface and 10.6% from the interior of the fruit. On the seventh day 12.0% of the applied activity was recovered, 62% of this from the fruit surface. Only 6.3% of the total applied activity was still recoverable after 14 days, and the quantity in the interior of the fruit was still negligible.

76-2638. Thiem, L.; Badorek, D.; O'Connor, J. T. (Dep. Civil Engineering, Univ. Missouri, Columbia, MO). **Removal of mercury from drinking water using activated carbon.** *J. Am. Water Works Assoc.* 68(8): 447-451; 1976. (7 references)

Means for removing trace concentrations of mercury II from drinking water supplies, utilizing existing treatment facilities, were studied. Adsorption of mercury II by powdered activated carbon is one alternative. The degree of removal depends on the pH of the medium; a noticeable decrease in the adsorption of mercury occurs as the pH increases. The addition of chelating agents such as EDTA prior to contact with activated carbon measurably improved the removal achieved using carbon alone. As low a concentration as 0.02 mg/l EDTA or 1 mg/l tannic acid increased removals by 10-30%, depending on the carbon dose applied and the pH of the system. Calcium ion had a similar effect. As the calcium ion concentration was raised from 50 to 200 mg/l, the mercury removal increased 10-20% over those obtained by using carbon alone. Thus it is concluded that the presence of a chelating agent will enhance the removal of mercury from drinking water using powdered activated carbon as an adsorbent.

76-2639. Read, D. C. (Res. Stn., Agric. Canada, Charlottetown, Prince Edward Island, Canada). **Comparisons of residual toxicities of twenty-four registered or candidate pesticides applied to field microplots of soil by different methods.** *J. Econ. Entomol.* 69(4): 429-437; 1976. (6 references)

Comparative toxicities throughout the growing season for 24 new pesticides, including treatments applied on the soil surface, mixed into the upper 3 cm of soil and banded 3 cm below the surface, are presented graphically from data obtained in tests conducted during 1971, 1972, and 1973. When placed on the soil surface, most materials were initially highly toxic to test larvae and showed a continuous and relatively rapid loss of toxicity during the season. However, a few compounds, such as phosmet, phenamiphos, and fonofos, appeared to be more resistant to photochemical degradation than others, such as phorate and propoxur. When mixed into the upper 3 cm of soil, toxicants of the most persistent compounds, as phoxim, fonofos, and pirimiphos-ethyl, degraded much faster than when the parent materials were banded 3 cm below the soil surface. However, there were only minor differences in rate of toxicant degradation of soil-mix and subsurface band treatments by some of the less residual compounds, as phenamiphos, propoxur, and BAS2353 (3,5-diethylphenyl-*N*-methylcarbamate). Leptophos was the only compound tested that showed rapid initial loss of toxicity followed by an increase late in the season, both by the soil-mix and subsurface band methods of application. Efficient short or long term insect control must involve selection of the most suitable pesticide as its residual toxicity pattern relates to the life history and habits of the pest. (Author abstract by permission)

76-2640. Pree, D. J.; Butler, K. P.; Kimball, E. R.; Steward, D. K. R. (Res. Stn., Agric. Canada, Vineland Station, Ontario, Canada). **Persistence of foliar residues of dimethoate and azinphosmethyl and their toxicity to the apple maggot.** *J. Econ. Entomol.* 69(4): 473-478; 1976. (12 references)

Field tests indicated that dimethoate was more toxic than azinphosmethyl to adults of *Rhagoletis pomonella* (Walsh) caged on sprayed foliage. Based on probit analysis using foliar residues, the LC for dimethoate was 2-10 times less than that for azinphosmethyl. Time till 50% kill (ET50) was 5-10 days longer for dimethoate than for azinphosmethyl. EC formulations were not effective longer than WP formulations. Initial deposits of azinphosmethyl on foliage were higher than those of dimethoate regardless of formulation used. Highest initial deposits occurred when the EC fomulation of azinphosmethyl was applied. Loss of residues from foliage closely fitted a 3 parameter asymptotic regression curve with the equation $Y = A + BR^x$, where Y is the amount of residue remaining at time X, A is the asymptote of Y, B is the scaling constant, and R is the rate of degradation. Although azinphosmethyl residues persisted at higher levels than dimethoate throughout, the rate of loss was similar for each compound, regardless of formulation used. (Author abstract by permission)

76-2641. Harper, L. A.; White, A. W., Jr.; Bruce, R. R.; Thomas, A. W.; Leonard, R. A. (Southern Piedmont Conserv. Res. Cent., Watkinsville, GA 30677). **Soil and microclimate effects on trifluralin volatilization.** *J. Environ. Qual.* 3(3): 236-242; 1976. (31 references)

A large fraction of many applied pesticides are lost to the air and dissipated. Microclimatological methods were used to determine the diurnal loss rates by volatilization of trifluralin applied and incorporated into the soil of a 1.26-ha upper Piedmont plateau watershed. Trifluralin flux decreased to very low levels during daytime when surface soil water content was low even though turbulence, soil temperature, and evaporative demand were high. During nighttime, when evaporative demand subsided and the surface soil water content increased, the trifluralin flux increased as the surface soil water content increased. Trif-

luralin and lindane flux on a limited plot-size study were compared and both pesticides reacted similarly to environmental conditions, except lindane volatilized more rapidly. When the soil surface was not wet, trifluralin and lindane fluxes appeared to be controlled by surface soil water content and the water content's effect on pesticide adsorption to the soil particle. Apparently, adsorption to the soil particle upon soil drying is a reversible process since efflux of the pesticides was rapid when soil was rewetted by drew or rainfall to above the equivalent of three molecular layers of adsorbed soil water. Under controlled soil-water conditons, where the soil surface remained wetter than three molecular layers of adsorbed soil water. Under controlled soil-water conditions, where the soil surface remained wetter than three molecular layers of adsorbed water, the pesticide fluxes responded to increased soil temperature and turbulence, and atmospheric stability conditions. (Author abstract by permission)

76-2642. Guenzi, W. D.; Beard, W. E. (Agric. Res. Serv., Western Region, Fort Collins, CO 80522). **The efffects of temperature and soil water on conversion of DDT to DDE in soil.** *J. Environ. Qual.* 3(3): 243-246; 1976. (13 references)

A laboratory study was conducted to determine the rates of DDT (1,1,1-trichloro-2,2-bis[*p*-chlorophenyl]-ethane) degradation and DDE (1,1-dichloro-2,2-bis[*p*-chlorophenyl]ethylene) formation in soil. Degradation rates increased with higher temperatures and in the presence of water. Of the DDT mixed with Raber silty clay loam, 82.1, 74.5, 53.2, and 38.3% was recovered as DDT and 6.7, 12.5, 21.6, and 34.8% as DDE after 140 days incubation at 30, 40, 50, and 60°C, respectively. A comparison of DDE formation in sterile and nonsterile soil showed that 84% of the conversion was due to a chemical process at 30C and 91% at 60°C. In sterile systems at 30°C, rates of DDE formation were similar in submerged soil and soil at 1/3 bar suction, and both were much higher than in air-dried soil. (Author abstract by permission)

76-2643. Bowmer, K. H.; O'Loughlin, E. M.; Shaw, K.; Sainty, G. R. (Div. Irrig. Res., CSIRO, Griffith, New South Wales, Australia). **Residues of dichlobenil in irrigation water.** *J. Environ. Qual.* 3(3): 315-319; 1976. (15 references)

Field trials were made on two unlined irrigation channels to measure the extent of water contamination due to residues of dichobenil (2,6-dichlorobenzonitrile) which had been applied to the empty channel the previous winter. Ten weeks after application, the herbicide remaining in the soil was about 6% of the initial application. About 4 months after application, water was passed through the channels and washed into drains. The maximum herbicide concentration in this flushing water was 0.18 ppm and was judged to present no potential hazard to crops. The need for prolonged channel flushing is questioned. An alternative procedure, displacing the static water in the channel following by a period of ponding, is suggested as a means of avoiding high herbicide residues in irrigation water. (Author abstract by permission)

76-2644. Kawar, N. S.; Dagher, S. M. (Fac. Agric. Sci., American Univ. Beirut, Beirut, Lebanon). **Fate of DDT and parathion in grapes processed into arak, an alcoholic beverage.** *J. Environ. Sci. Health* B11(3): 199-210; 1976. (18 references)

As DDT and parathion are commonly used on grapes in Lebanon, a study was undertaken to investigate the fate of these chemicals in grapes processed into the alcoholic beverage, arak. Six lots of a local variety of grapes were studied. Two lots were sprayed with a solution of 200 mg pure *p,p'*-DDT in absolute ethanol, for an initial concentration of 25 ppm. Two other lots were similarly treated with parathion. Samples on mine fractions produced from the fermentation and distillation steps were analyzed for DDT and parathion and their respective metabolites. DDT degraded to DDD (TDE) during fermentation, resulting in a sharp decrease in DDT levels. The final product contained less than 2% of the amount of DDT found in fresh grape juice. Although DDD increased sharply during fermentation, it also decreased to a negligible level during subsequent distillation procedures. Parathion was more stable than DDT during fermentation and first distillation steps. However, the second distillation caused a sharp decline in its level and the arak contained only about 6% of the residues present in the fresh juice, with *para*-nitrophenol being the only metabolite detected.

76-2645. Haque, A.; Weisgerber, I.; Kotzias, D.; Klein, W.; Korte, F. (Inst. Oekol. Chem., Gesellsch. Strahlen-Unweltforsch. mbH, Munchen, Munich, Germany). **Contributions to ecological chemistry part 112. Balance of conversion to buturon-^{14}C in wheat under outdoor conditions.** *J. Environ. Sci. Health* B11(3): 211-223; 1976. (10 references)

A study was made of the balance of conversion and disappearance of residues of buturon in winter wheat including the isolation and identification of metabolites. Buturon (C^{14}-labeled) was sprayed on winter wheat as an aqueous formulation (2.98 kg/ha) under outdoor conditions. On harvest three months later, a total of 49.2% of the radiocarbon was recovered: 2.0% in plants, 46.9% in soil, and 0.3% in leaching water to a depth of greater than 50 cm; and less than 0.1% in the grains (0.464 ppm). Mild extraction conditions were successful in removing only about half of the residue present in plants. About half of this was unchanged buturon. The following metabolites were identified in straw and husk extracts: *N*-(*p*-chlorophenyl)-*N*-methyl-*O*- methyl-carbamate, *N*-phenyl- *N'*-formyl-

urea, two unstable giving (*p*-chloro-phenyl)- isocyanate on purification, *N*-(*p*-chlorophenyl)- *N*'-methyl- *N*'-isobutenylol-urea, *p*-chloroformanilide, and biologically bound *p*-chloroaniline. In the root and basal stem extract the following metabolites were noted: *N*-(*p*-chlorophenyl)-*O*-methyl- carbamate and *N*-(*p*-chlorophenyl)- *N*'-methyl-urea.

76-2646. Tomizawa, C.; Uesugi, Y.; Ueyama, I.; Yamamoto, H. (Natl. Inst. Agric. Sci., Kita-Ku, Tokyo, Japan 114). **Movement and metabolism of *S*-benzyl *O*,*O*-diisopropyl phosphorothiolate (Kitazin P) and *O*-ethyl *S*,*S*-diphenyl phosphorodithiolate (edifenphos) in various types of soils.** *J. Environ. Sci. Health* Bll(3): 231-251; 1976. (20 references)

The movement and metabolism of ^{32}P and ^{35}S-double labeled Kitazin P and ^{35}S-labeled edifenphos were examined in sandy loam, alluvial clay loam, and volcanic ash loam. The order of mobility for vertical movement of the compounds in soil columns was sandy loam > alluvial clay loam > volcanic ash loam. The persistence of edifenphos was shorter than that of Kitazin P. At the initial stages of metabolism the major degradation products were *S*,*S*,*S*,-triphenyl phosphorotrithiolate, *O*,*O*-diethyl *S*-phenyl phosphorothiolate, *S*-phenyl dihydrogen phosphorothiolate, and diphenyl disulfide for edifenphos and *O*,*O*-diisopropyl hydrogen phosphorothioate for Kitazin P. Under flooded conditions of alluvial clay loam, Kitazin P was slightly more persistent as compared with upland conditions. Sterilized conditions did allow for any appreciable degradation of Kitazin P throughout the period, but such conditions did not necessarily prevent the degradation of edifenphos.

76-2647. Mathur, S. P.; Sirois, J. C. (Soil Res. Inst., Res. Branch, Agric. Canada, Ottawa, Ontario, K1A OC6, Canada). **1,2-Benzanthracene in soil.** *J. Environ. Sci. Health* Bll(3): 265-270; 1976. (15 references)

The content of 1,2-benzanthracene was measured in several soils of urban and rural areas, including experimental plots subjected to burning of wheat stubble for 15 years. Samples from three cultivated soils and from a roadside contained from less than 1 to 68 ppb of 1,2-benzanthracene. Two plots which were subjected to stubble (residue of wheat crop) burning did not contain significant amounts of the chemicals, even though polyaromatic hydrocarbons, including 1,2-benzanthracene, do result from pyrolysis of most organic matter. From these findings it is concluded that 1,2-benzanthracene occurs in some cultivated soils and in an urban soil which may receive such pollution from polluted air. Burning of stubble, however, appears not to have led to an accumulation of 1,2-benzanthracene in a cultivated soil, perhaps due to its degradation in the intervals between annual burnings and possible losses through volatilization during the stubble burning.

76-2648. Ehmann, J. (Pestic. Res. Ctr., Michigan State Univ., East Lansing, MI 48824). **A model system: a photochemical interaction between heptachlor and the surface waxes of the tomato fruits.** *J. Photochem.* 5(2): 199; 1976.

The C_{27} alkanes and C_{27} ketones were exposed to photolysis at 310 nm for 5 days (the equivalent of 2 wk of summer sunlight) in the presence of heptachlor, acetone, and benzene. The resulting photoproducts were islolated and analyzed by gas chromatography and combined gas chromatography-mass spectrometry. Two monodechlorinated isomers eluted at 155°C. At 280°C, a multiplicty of radical-coupling dimers eluted as dimers at C_1 or C_3 of the allyl chlorine of the cyclopentadiene fraction of the heptachlor molecule.

76-2649. Young, D. R.; McDermott, D. J.; Heesen, T. C. (S. Calif. Coastal Water Res. Proj., El Segundo, CA). **DDT in sediments and organisms around southern California outfalls.** *J. Water Pollut. Control Fed.* 48(8): 1919-1928; 1976. (6 references)

Findings of chlorinated hydrocarbon pollution over the last several years in major wastewater inputs and on its spatial and temporal distributions in ocean bottom sediments, crabs, and flatfish collected near Los Angeles are summarized. The marine ecosystem off southern California is still highly contaminated. The major contamination source appears to be industrial wastes discharged in Los Angeles County municipal wastewaters, accounting for more than 95% of the total DDT measured in municipal wastewaters released to this ecosystem. About 200 metric tons of chlorinated hydrocarbons accumulated in bottom sediments within a 50 km^{27} area of the Palos Verdes shelf. Benthic crabs and flatfish showed large contamination gradients. The principal compound measured in both the surface sediments and the muscle tissue of the organisms was *p*,*p*'-DDE. Even though the discharge of total DDT dropped from almost 22 metric tons in 1971 to less than 2 metric tons in 1974, little change was noted in surface sediment concentrations on the Palos Verdes shelf. Dover sole from this region showed no significant decreases over a 3-yr interval. Thus it is concluded that the sediment reservoir of DDT wastes off Palos Verdes Peninsula may now be the dominant source of this contaminant to the benthic organisms in this region of the coastal ecosystem.

76-2650. Gvozdikova, L. G.; Mazur, V. K.; Berlyant, O. R.; Solov'eva, E. I. (Ukrainian Scientific Research Institute of Canning Industry, USSR). **Izmenenie ostatochnykh kolichestv insektitsida antio v protsesse vegetatsii tomatov. [Change in the anthio residue levels in the course of the vegetation of tomato plants.]** *Konserv. Ovoshchesush. Prom.* 5: 37-38; 1976. (Russian)

The changes in anthio (formothion) residue levels in tomato fruits were studied by a thin-layer chromatographic method with a sensitivity of 0.04 mg/kg. The tomato plants were sprayed with a 0.2% aqueous solution of anthio, once at the time of appearance of the fruits, and again

14 days later. Rain fell on the day following the second treatment. The anthio levels in the fruits were 0.24 mg/kg one day after the first treatment and 0.20 mg/kg after 3 days. The residue level was 0.066 mg/kg following the second treatment and 0.02 mg/kg 3 days after the second treatment. Traces of anthio were found 7 days after the second treatment, but there were no traces at all on the 10th day. The findings indicate rapid elimination of anthio from tomato fruits.

76-2651. Schlatter, C. (Inst. Toxikol., Univ. Zurich, Zurich, Switzerland). **Schadstoffe in Lebensmitteln tierischer Herkunft. [Undesirable materials in foods of animal origin.]** *Mitt. Geb. Lebensmittelunters. Hyg.* 67(2): 200-211; 1976. (52 references) (German)

Chlorinated hydrocarbon insecticides and PCBs unintentionally find their way into food of animal origin. Concentrations of these chemicals have been found to be ten times higher in animal fat than in the feed the animals eat. For other substances such as mycotoxins and heavy metals, however, the animal acts as a filter and the content in the animal is 10-100 times lower than that in the feed. The use of arsanilic acid as a feed additive is prohibited in many countries due to fears of carcinogen city. Carcinogenicity has been shown for inorganic As_2O_3, but not for organic arsenic compounds. A carcinogenic effect of stilbestrol is viewed as most unlikely considering the minimal quantities potentially found in meat. The nitrites added during processing may react with amines in the product or in the human stomach, yielding the carcinogenic nitrosamines. However, the exposure level of the consumer is presently about 1000 fold below that of the dose found to be carcinogenic in laboratory animals. Smoke cured meats contain only insignificant amounts of carcinogenic polycyclic aromatic hydrocarbons.

76-2652. Ogden, J. C.; Robertson, W. B.; Davis, G. E.; Schmidt, T. W. (Everglades National Park, Homestead, FL 33030). **Pesticides, polychlorinated biphenols [*sic*] and heavy metals III. Upper food chain levels, Everglades National Park and vicinity.** *Natl. Tech. Inform. Serv.*, PB-235 359, 1974, 27p. (29 references)

An extensive survey was made of chlorinated insecticides, polychlorinated biphenyls, and metals in upper trophic levels of material collected in and adjacent to Everglades National Park. The collections were made between 1971 and 1973. Data revealed that DDT, DDE, DDD, dieldrin, and PCBs appear to exist in concentrations well below amounts known to have either acute or chronic effects. Various concentrations of metals were also reported and the significance of these is not fully known. It is suggested that more extensive study be given to the finding of mercury in freshwater vertebrates and arsenic in marine species. It is further suggested that a regular program to monitor amounts of environmental poisons in upper trophic level species in the southern Everglades and adjacent estuaries should be established.

76-2653. Boehm, H. H.; Mueller, H. (Limnol. Inst. Univ. Freiburg, Konstanz-Egg, Germany). **Model studies on the accumulation of herbicides by microalgae.** *Naturwissenschaften* 63(6): 296; 1976. (3 references)

The accumulation, was studied of herbicides by the green algae *Scenedesmus acutus*. The herbicides used in the study included atrazine, 2,4-D, 2,4,5-T, and paraquat. With increasing water solubility of the herbicides tested, the absolute content in the algae at the final equilibrium phase decreased. The accumulation factor increased with lowered concentration in the water. A linear relation existed between the accumulation factor and the logarithm of atrazine concentration in the water. Carbon dioxide fixation and growth rate of *Scenedesmus* showed a similar response to the atrazine concentration in the water. Thus interaction between phytotoxic properties and the accumulation capacity are assumed. However, the sorption by heat-killed cells was independent of atrazine concentration in the water. It therefore seems that living cells possess supplementary sorption mechanisms compared with dead algae. After transfer of the contaminated algae into an atrazine-free medium, the compound was desorbed with a similar dependence on time as observed for sorption, but about 10% was bound irreversibly.

76-2654. Rajaram, K. P.; Sethunathan, N. (Lab. Soil Microbiol., Central Rice Res. Inst., Cuttack-6, Orissa, India). **Factors inhibiting parathion hydrolysis in organic matter-amended soil under flooded conditions.** *Plant Soil* 44(3): 683-690; 1976. (9 references)

The inhibition of parathion hydrolysis by added organic sources was studied under flooded soil conditions. Glucose caused maximum inhibition of hydrolysis, and the studies indicated that the increased populations of microorganisms as a result of glucose application were involved in the inhibition of hydrolysis in nonfiltered solutions. Apparently glucose-enhanced microbial activity was detrimental to parathion-hydrolyzing microorganisms. The addition of rice straw also inhibited parathion hydrolysis. During the decomposition of rice straw a heat-stable factor which inhibited the hydrolysis of parathion developed in 36 hr in soils inoculated at the start of flooding and persisted until 90 days after flooding. This toxic factor was not inactivated by steam treatment.

76-2655. MacDonald, K. B.; McKercher, R. B.; Moyer, J. R. (Univ. Saskatchewan, Saskatoon, Saskatchewan, Canada S7N OWO). **Picloram displacement in soil.** *Soil Sci.* 121(2): 94-102; 1976. (18 references)

A study was made to determine whether picloram is translocated out of the surface layer under dryland field conditions and to compare the movement of picloram to a wetting front under irrigated field conditions in a light-textured soil with a high pH and low organic matter content. When applied in a field study at rates up to 2.24 kg/ha, picloram was retained within the rooting zone (1-120 cm) in a coarse-textured low organic matter soil that received

about double the average natural precipitation by supplemental irrigation. When vegetation survived on the soil, water absorption by the plants decreased both water and picloram penetration into the soil. Organic matter greatly reduced picloram concentration in soil solution and slowed its movement through the soil. Although clay is much less important, it does have implications for picloram movement within the soil. Retardation factors may aid in estimating the rates of release of chemicals for plant uptake and thus be valuable in estimating rates of application. They may also aid in estimating the relative mobility of the chemical through the soil.

76-2656. Melikadze, L. D.; Shoniya, D. A.; Kvinikadze, M. D.; Berba, I. P. (Acad. Sci. Georgia SSR, Tbilsi, USSR). **O prodolzhitel'nosti deystviya preparata PLK v prirodynkh usloviyakh. [The duration of the action of preparation PLK under natural conditions.]** *Soobshch. Akad. Nauk Gruz. SSR* 79(3): 709-712; 1975. (2 references) (Russian)

Determination of the chlorine content in acetone extracts of the bark of spruce trees treated with the preparation PLK under natural forest conditions revealed that hexachlor (BHC), its toxic principle, was preserved for over 4 yr. Biological tests indicated that trees treated with preparation PLK were lethal to European spruce beetles for more than 4 yr.

76-2657. Vela, G. R.; Rainey, J. G. (Dep. Biol. Sci., North Texas State Univ., Denton, TX 76203). **Microbiological degradation of phenol in the effluent from a wood treatment plant.** *Tex. J. Sci.* 27(1): 197-206; 1976. (11 references)

The bacterial degradation of pollutants present in the effluent water from a treatment yard of a wood preserving plant was studied in North Texas. The plant effluent formed a continuously running stream of water from steam condensation in retorts used for impregnation of railroad ties, utility poles, and other heavy construction lumber with creosote and creosote plus 5% pentachlorophenol. The results of these laboratory studies suggest that the high degree of autopurification in aerated effluent can be enhanced by proper conditions and also that these conditions are not so rigorous that they would be restricted to laboratory use. Extrapolation from the data of this study shows that requisites for maintaining proper temperatures, adequate aeration, and large bacterial populations are criteria which must be incorporated into the design of a facility for effluent treatment. Data is being collected on the efficiency of a proposed system.

76-2658. Spynu, E. I.; Ivanova, L. N. (All-Union Sci.-Res. Inst. Hyg. Toxicol. Pestic., Polymers, and Plastics, Kiev, URRS). **Modelirovaniye raschetov zagryazneniya pestitsidami produktov rasteniyevodstva. [Modeling of calculations of pesticide contamination of plant crops.]** *Vop. Pitan.* 1: 76-80; 1976. (5 references) (Russian)

Unified material, including data from the literature and original research on the kinetics of pesticide in plant crops, was used to construct a mathematical model using probability algorithms of the method of group calculation of arguments based on the image recognition theory proposed by A. G. Ivakhchenko and coauthors. Twenty-two indices were considered: molecular weight of the chemical (in moles): melting temperaure (in °C); solubility in fats (in points); solubility in water (in g/l); stability at a pH of 5.0-8.0 (in points); volatility (in mg/m^3); stability at a pH of less than 5.0 (in points); stability at a pH of greater than 8.0 (in points); pH of the crop; water content in the plant; total acidity of the crop; nitrogenous substances in the crop; fats in the crop; cellulose; ash; pectin substances; proteins; total sugar content (the indices referring apply to the plant crop and are expressed in % of dry weight); number of treatments of crops; standard for utilization of the chemical applied; average air temperature for the period extending from the moment of treatment to the end of the study; total precipitation for that same period in the given region. A formula was devised for the prediction of the level and duration of the content of a pesticide in the studied object. Comparison with computational and factual data indicated that the level of error of this method averaged ± 30%. Since the error of the method of measurement (primarily chemical methods of thin layer chromatography) average ± 20%, the accuracy of the described model may be considered satisfactory. This method of calculating the interaction of pesticides and the environment may be applied to the regulation of pesticide use and the prevention of plant crop contamination.

76-2659. Al-Bahrani, K. S.; Martin, R. J. (Dep. Civil Engineering, Univ. Birmingham, Birmingham B15 2TT, England). **Adsorption studies using gas-liquid chromatography—1.** *Water Res.* 10(8): 731-736; 1976. (13 references)

The effect of molecular structure was studied on the adsorption of some selected low molecular weight aromatic pollutants from aqueous solution. Sorption was monitored by gas-liquid chromatography (GLC) with a flame ionization detector system using the direct injection of aqueous solutions. Compounds studied included phenol, aniline, benzyl alcohol, benzaldehyde, nitrobenzene, *o*-nitrophenol, *o*-cresol, *m*-cresol, *p*-cresol, 2-chlorophenol, 4-chlorophenol, *o*-methoxyphenol, 2-naphthol, *o*-toluidine, *p*-toluidine, *o*-anisidine, *m*-anisidine, *p*-anisidine, anisaldehyde, salicylaldehyde, vanillin, pyridine, 2-methylpyridine, quinaldine, pyrrole, and indole. Some of these compounds are important pesticide breakdown products. Equilibrium data for the adsorption of individual compounds correlated with both the Langmuir and Freundlich equations. There was a general tendency of increase in adsorption capacity with increase in molecular weight. The carbon capacity for the adsorption of the polycyclic compounds was higher than that for the corresponding monocyclic compounds. No general

tendency of increase in adsorption with increase in solubility was noted. If the dipole moment can be used to measure the polarity of a compound, then no correlation was noted between polarity and the carbon capacity for the adsorption of the compounds studied. Adverse effect of the OH, CH_2OH, and NH_2 groups on adsorption may be attributed to the capability of these groups to form hydrogen bonds with the water, rendering the compound less adsorbable. The introduction of OCH_2 groups generally had a favorable effect on carbon adsorption. The isomers did not follow any particular pattern in their adsorption.

76-2660. Dyadicheva, T. V.; Khokhol'kova, G. A.; Davydova, T. K. (Kiev Res. Inst. Ind. Hyg. Occup. Dis., Kiev, USSR). **Gigyenicheskaya otsenka fumigatsii pochvy emul'siyey serougleroda. [Hygienic assessment of soil fumigation with a carbon disulfide emulsion.]** *Zashch. Rast. (Kiev)* 9: 32; 1974. (Russian)

A 40% aqueous emulsion was used to treat vineyard soil for the control of phylloxera. The quantity of CS in the air of the working area did not surpass permissible concentrations (10 mg/m³) and was 4-18 times lower in many cases. Higher concentrations were found only in areas where sprayers were fixed or filled. Treating soil at a deeper level (35 cm) decreased CS_2 content in the air. The concentration of the fumigant in the air exceeded permissible levels by 1.3-2 times but no CS_2 was detected after 2-3 days. Insignificant amounts of CS_2 were found 50 and 100 m from the treated area during fumigation. A total of 0.01-0.02 mg/100 cm² of CS_2 were found in the wash water from unprotected hands. Washing with soap totally removed CS_2 from the hands.

76-2661. Gruzdev, G. S.; Bereznikov, G. A. (Div. Chem. Ag. Plant Protect., K. A. Timiryazev Agricultural Academy, Moscow, USSR.) **Deystviye i posledeystviye smesey gerbitsidov atrazina, 2,4-D i tordona v posevakh na chernozemnykh pochvakh. [The effect and aftereffect of mixtures of the herbicides atrazine, 2,4-D, and Tordon in plantings on chernozem soils.]** *Izv. Timiryazev. Skh. Akad.* 3: 149-156; 1974. (5 references) (Russian)

The effectiveness of mixtures of atrazine (3 and 4 kg/ha), 2,4-D (1.2 kg/ha), and Tordon 22-K (potassium salt of picloram, 0.15 and 0.3 kg/ha) in cornfields was studied in the Tambov region in 1970-1973. Tordon (0.3 kg/ha) applied alone or with atrazine decreased winter wheat yield in the two succeeding years. The lower Tordon dose and the other herbicides had no persistent effect. At 24 mo after application Tordon had no effect on sunflower growth, but did decrease the height and weight of peas 1.5-2.5 fold. Residues of atrazine and Tordon in soil 1 and 4 mo after application were greater in the 0-10 cm layer than in the 10-20 cm layer, and Tordon decomposed more slowly than atrazine. Four months after application, 15.4-35.7% of the applied amount of atrazine remained in the 0-10 cm soil layer, and 27.9-50.9% of the applied amount of Tordon remained. The unusual persistence of low Tordon levels was primarily attributed to the extremely dry weather in 1972.

76-2662. Gabica, J.; Benson, W.; Loomis, M. (Epidemiol. Stud. Program, Dep. Health Welfare, Boise, ID 83720). **Total mercury levels in selected human tissues, Idaho—1973-74.** *Pestic. Monit. J.* 9(2): 59-63; 1975. (15 references)

Total mercury levels were determined in human tissues taken at autopsy from six hospitals in the three basic geographical areas of Idaho. Of the 242 specimens analyzed, 76 percent contained detectable mercury. Levels were compared with respect to the age, sex, and geographic residence of autopsied individuals. Mean levels detected were 1.04 ppm in kidney tissue, 0.34 ppm in liver, and 0.08 ppm in brain. Mean mercury levels for the three geographical areas were: southeastern Idaho, 0.22 ppm; southwestern Idaho, 0.80 ppm; and northern Idaho, 0.43 ppm. The relatively high means in southwestern Idaho specimens may be related to the preponderance of natural cinnabar deposits in that portion of the state. Mercury levels were higher in women than men for all tissues in both the southwestern and northern areas, but the reverse was true in the southeast. Data was compared with findings of other investigators in an attempt to arrive at background levels of total mercury residues in human tissues. (Author abstract by permission)

76-2663. White, D. H. (Fish Wildlife Serv., Patuxent Wildlife Res. Cent., Laurel, MD 20811). **Residues of DDT and DDE in livers of waterfowl, northeastern Louisiana—1970-71.** *Pestic. Monit. J.* 10(1): 2-3; 1976. (9 references)

A study was conducted to determine the levels of DDT and DDE in the livers of 10 species of waterfowl collected in Louisiana from 1970 to 1971. Livers of 48 of 50 specimens contained detectable levels of DDT and/or DDE. DDT residues ranged from 0.01 to 10.90 ppm; DDE levels ranged from 0.02 to 38.69 ppm. (Author abstract by permission)

76-2664. Stendell, R. C.; Ohlendorf, H. M.; Klaas, E. E.; Elder, J. B. (Fish Wildlife Serv., Patuxent Wildlife Res. Cent., Laurel, MD 20811). **Mercury in eggs of aquatic birds, Lake St. Clair—1973.** *Pestic. Monit. J.* 10(1): 7-9; 1976. (19 references)

Eggs from four species of aquatic birds inhabiting waterways of the Lake St. Clair region were collected in 1973 and analyzed for mercury. Species analyzed were mallard ducks (*Anas platyrhynchos*), common terns (*Sterna hirundo*), black-crowned night herons (*Nycticorax nycticorax*), and great egrets (*Casmerodius albus*). Mallard eggs contained relatively low residue levels, < 0.05-0.26 ppm, and common tern eggs contained the highest residues, ranging up to 1.31 ppm. Mercury levels in the eggs were appreciably lower than those in the same species in 1970. The declines are attributed to the 1970 restrictions

placed on industrial discharges of mercury into the St. Clair and Detroit Rivers. (Author abstract by permission)

76-2665. White, D. H. (Fish Wildlife Serv., Patuxent Wildlife Res. Cent., Laurel, MD 20811). **Nationwide residues of organochlorines in starlings, 1974.** *Pestic. Monit. J.* 10(1): 10-17; 1976. (7 references)

Organochlorine residues in starlings (*Sturnus vulgaris*) from 126 collection sites were monitored during the fall of 1974. DDE, DDT, polychlorinated biphenyls (PCBs), and benzene hexachloride were present in all samples. Dieldrin, heptachlor expoxide, hexachlorobenzene, and oxychlordane were present in approximately 97 percent of the samples. DDE, dieldrin, and PCB residues in starlings were significantly lower than they had been in 1972. (Author abstract by permission)

76-2666. Carrasco, J. M.; Cunat, P.; Martinez, M.; Primo, E. (Tech. Sch. Agric. Eng., Valencia, Spain). **Pesticide residues in total diet samples, Spain—1971-72.** *Pestic. Monit. J.* 10(1): 18-23; 1976. (14 references)

Average pesticide residue levels were determined for the 17 main food groups in the average Spanish diet. Using these levels and the estimated average intake of these foods, authors computed an individual's average daily consumption of pesticides from each of these food groups and her/his total diet. Foods were acquired over a 1-year period from the market of Valencia, a city that gets supplies from an agricultural area where pesticide consumption is appreciably higher than that of the rest of the country. Thus average residue levels found must be higher than the national average. Except for fruits and vegetables, the different items composing each food group were sampled in proportion to the amount consumed in the average Spanish died. Foods forming each group were homogenized into composite samples. All foods were analyzed raw. The most freqently detected pesticides were DDT and BHC. Malathion was detected at levels less than 0.10 ppm in some samples of vegetable oils, pears, and apples. DDT and BHC levels varied from undetectable to amounts less than 1.0 ppm. Highest levels were found in lard. An individual's average daily intake of pesticides was calculated to be 78 μg DDT, a sum which includes residues of *o,p'*-DDT, *p,p'*-DDT, and *p,p'*-DDE, and 13.8 μg γ-BHC. These levels are much lower than the United Nations Food Agricultural Organization and World Health Organization. (Author abstract by permission)

76-2667. Tanita, R.; Johnson, J. M.; Chun, M.; Maciolek, J. (Stanford Res. Inst., Arlington, VA). **Organochlorine pesticides in the Hawaii Kai Marina, 1970-74.** *Pestic. Monit. J.* 10(1): 24-29; 1976. (12 references)

Sediments, water, and oysters from the receiving waters of the Hahaione Valley, a suburban development in southeastern Oahu, Hawaii, were analyzed for organochlorine pesticidal compounds. The insecticides dieldrin, α- and γ-chlordane, and *p,p'*-DDT were found in the study site environment. Levels were in the low parts per billion range for oysters and sediments and in the low parts per trillion range for water. During the past several years dieldrin residues in the marina study site have increased, even though the only activity known to influence pesticide levels in the valley is the chronic treatment for subterranean and dry wood termites. If present trends continue, dieldrin may pose a threat to biota of the aquatic environment. Findings have shown that residue levels of dieldrin and *p,p'*-DDT in the sediments are within the LD50 range for estuarine fish and thus may have a deleterious effect on bottom-feeding organisms. According to present standards of the Food and Agriculture Organization/World Health Organization, pesticide residue levels within the study site do not appear to constitute a health hazard to humans. (Author abstract by permission)

76-2668. Hansen, D. J.; Wilson, A. J.; Nimmo, D. W. R.; Schimmel, S. C.; Bahner, L. H.; Huggett, R. (EPA, Environ. Res. Lab., Gulf Breeze, Fl 32562). **Kepone: hazard to aquatic organisms.** *Science* 193(4253): 528; 1976.

The hazard of Kepone to aquatic organisms in the James River and the Chesapeake Bay are the concerns of this letter to the editor. On-site tests of organisms taken from the James River showed significant Kepone concentrations. Concentrations in edible tissues of most fresh and estuarine fin- and shellfish commonly ranged from 0.1 to more than 1 μg/ppm. These exceeded allowable health limits. Kepone concentrations have been seen to increase in anadromous fishes as they spend more time in this river. Kepone is highly bioaccumulative and persists in estuarine organisms. Oysters, grass shrimp, and fishes have been shown to bioconcentrate Kepone from 425 to 20,000 times the concentration in the surrounding water. Action levels for edible seafood now in force might be reached by as little as 5 parts of Kepone per trillion parts of water. Kepone is acutely toxic to estuarine organisms, but long-term bioassays reveal that the hazard to these organisms is greatly underestimated by the 96-hour tests. The threat of an even greater impact of Kepone to aquatic organisms in the James River and expansion of this impact into the Chesapeake Bay, therefore, is real and may continue for some years to come.

76-2669. Katan, J.; Fuhremann, T. W.; Lichtenstein, E. P. (Dep. Entomol., Univ. Wisconsin, Madison, WI 53706). **Binding of [^{14}C]parathion in soil: reassessment of pesticide resistence.** *Science* 193(4256): 891-894; 1976. (19 references)

A steady decrease of extractable [^{14}C]parathion residues in soils over a 1-month incubation period was accompanied by an increase of unextractable, bound ^{14}C-labeled residues, resulting finally in total recoveries of extracted plus bound residues of 80 to 87 percent of the applied radiocarbon. Soils containing bound residues were nontoxic to fruit flies. Binding of ^{14}C-labeled residues was

related to the activity of soil microorganisms; soil sterilization resulted in a reduction of binding by 58 to 84 percent. Under flooded (anaerobic) conditions, the binding of compounds labeled with ^{14}C doubled, and parathion was reduced to aminoparathion. Reinoculation of sterilized flooded soil fully reinstated the binding capacity. [^{14}]Aminoparathion was preferentially bound to soil, since its binding within 2 hours was 30 times greater than that of [^{14}C]parathion. Because of the existence of formely "unseen," unextractable residues, the concept of "persistent" and "nonpersistent" pesticide residues might have to be reconsidered. (Author abstract by permission. Copyright 1976 by the American Association for the Advancement of Science)

76-2670. Matthews, H. B.; Domanski, J. J.; Guthrie, F. E. (Nat. Inst. Environ. Health Sci., Research Triangle Park, NC). **Hair and its associated lipids as an excretory pathway for chlorinated hydrocarbons.** *Xenobiotica* 6(7): 425-429; 1976. (11 references)

Chlorinated hydrocarbon insecticides and other halogenated compounds, probably biphenyls, were found to be associated with human hair at concentrations less than 1 ppm. In experiments with rats, chlorinated ^{14}C-hydrocarbon insecticides and polychlorinated biphenyls were excreted in hair in all instances, but excretion was less with the more labile compounds. Excretion via hair may be a significant factor in eliminating chlorinated hydrocarbons which resist metabolism. (Author abstract by permission)

See also **76-2719** **76-2740** **76-2747** **76-2836** **76-2840** **76-2870**

76-2671. Okonek, S. (Cent. Detox. Poisons Inform., II. Med. Clin., Univ. Mainz, Mainz, Germany). **Probable progress in the therapy of organophosphate poisoning. Extracorporeal hemodialysis and hemoperfusion.** *Arch. Toxicol.* 35(3): 221-227; 1976. (27 references)

The potential utility of extracorporeal hemodialysis or hemoperfusion with coated activated charcoal for eliminating organophosphates following poisoning with nitrostigmine (parathion), demeton-*S*-methyl sulfoxide, or dimethoate was examined. Nitrostigmine could not be hemodialyzed. The other two organophosphates, on the other hand, could be readily eliminated from the blood by hemodialysis. The clearance rates for demeton-*S*-methyl sulfoxide and dimethoate were 52.98 ml/min and 59.07 ml/min respectively, at a blood flow rate of 100 ml/min. The clearance values for hemoperfusion with coated activated charcoal were higher under the same trial conditions, the values being 83.70 ml/min for demeton-*S*-methyl sulfoxide and 87.84 ml/min for dimethoate. Nitrostigmine, too, could be eliminated from the blood by hemoperfusion, its clearance being 59.20 ml/min. These results from in vitro hemoperfusion were verified on a patient admitted with nitrostigmine intoxication following attempted suicide. (Author abstract by permission)

76-2672. Laithwaite, J. A. (Law Hosp., Carluke, Kanarkshire, England). **Paraquat poisoning treated with immunosuppressants and potassium aminobenzoate.** *Br. Med. J.* 1(5952): 266-267; 1975.

A 32 yr old schizophrenic man was admitted seven days after drinking between one-quarter and one-third of a cup of Gramoxone (paraquat) diluted with orange juice in a suicide attempt. Five days after admission his condition was compatible with severe paraquat poisoning. Treatment had been initially along standard lines with high dosage of steroids, prednisolone (100 mg/day), and prophylactic antibiotics. At this time it was decided to try immunosuppressant therapy, certain features of the case resembled those of massive pulmonary fibrosis. It was considered possible that a delayed immune response might account in part for his lung damage. Azathioprine (50 mg, 4 times/day) was given along with potassium aminobenzoate as an antifibrotic measure. Immunophoresis of gammaglobulins showed proportional reductions after therapy started, the IgG level being reduced to 5.83 g/l. After about 4 weeks the lung appearances began to improve, and after seven more days there was further resolution of the lesions. His blood urea level began to fall and reached 10.3 mmol/l, creatinine level reached 61.9 μmol/l and the pO_2 rose steadily. These changes were all associated with a progressive clinical improvement which has been maintained, although his lung changes have not yet completely resolved.

76-2673. Loranskiy, D. N.; Bulay, L. A. (Cent. Res. Inst. Sanit. Educ., Minist. Health USSR, Moscow, USSR). **Gigienicheskoye obucheniye i vospitaniye rabotayushchikh s yadokhimikatami v sel'skom khozyaystve SSSR. [Hygienic training and education of individuals working with pesticides on collective farms in the USSR.]** *Gig. Sanit.* 2: 61-65; 1976. (4 references) (Russian)

Educational measures discussed include annual courses for the hygienic preparation of workers exposed to pesticides and an introductory and follow-up session for those beginning to work with pesticides. Such programs offer an introduction to the use of chemicals for plant protection, characteristics of the basic groups of pesticides, decontamination procedures, personal hygiene, and the protection of the environment from pollution with pesticides. New government programs instituted in 1972 included information on decontamination of transport equipment and other apparatus, special clothing, and first aid for pesticide intoxication. An example of successful educational measures in the Kiev oblast (USSR) is presented. Participation of Red Cross workers and other medical personnel in the training and education of farm workers and the use of health promoting films, posters, and literature in addition to lectures are also discussed.

76-2674. Mustacchi, P. (Dep. Med., Sch. Med., Univ. California, San Francisco, CA 94143). **Arterial hypertension and the work environment: some considerations affecting its compensability.** *J. Occup. Med.* 18(8): 561-566; 1976. (75 references)

Reference is made in this review article to a modest excess of hypertension reported among workers formulating pesticides composed of chlorophenoxy derivatives. However, it is suggested that the excess could be explained in large part by a greater constitutional predisposition in these workers as estimated by a family history positive for hypertension.

76-2675. Fisher, H. K.; Williams, G. (Pulmonary Sect., VA Wadsworth Hospital Center, Los Angeles, CA 90013). **Paraquat is not bacteriostatic under anaerobic conditions.** *Life Sci.* 19(3): 421-426; 1976. (15 references)

To test the hypothesis that bacteriostasis by paraquat (*N,N'*-dimethyl bipyridylium chloride) is dependent on its effect on electron transport, log-phase cultures of obligate and facultative anaerobes were exposed to 1 *M* paraquat. In the absence of the ultimate electron acceptor, oxygen, millimolar paraquat failed to inhibit bacterial growth, while aerobic growth was inhibited. Biological injury by paraquat requires the presence of oxygen in green plants and bacteria. These findings lend weight to reports that severity of paraquat-induced lung injury in mammals is related to oxygen tension. This has implications for treatment of paraquat poisoning, suggesting that decreased oxygen tension in the lungs of paraquat poisoning victims will be beneficial. Development of techniques for extracorporeal membrane oxygenation using veno-arterial bypass should allow such treatment. (Author abstract by permission, supplemented.)

76-2676. Collins, I. S.; Crawford, W. A. (Parramatta Hosp, Parramatta, New South Wales, Australia 2150). **Chlordane (Letter to the editor).** *Med. J. Aust.* 1(20): 762; 1976.

An unusual simultaneous occurrence of chronic monocytic leukemia was observed in a husband and wife. Careful anamnestic study revealed that each had been exposed to the long-term heavy use of chlordane, which had ended some time before the examinations were done. The association of chlordane with the hemopoietic changes were regarded as tentative and not as a cause-effect relationship. However, a cause-effect relationship was publicized by the news media which may have resulted in undue concern to many people. Further tests performed on these two patients revealed DDT, dieldrin, and BHC in lower amounts than those expected in the general population, but no traces of chemicals relevant to chlordane exposure. An extensive review of the literature has failed to show any association of chlordane or other pesticides with chronic monocytic leukemia or other neoplastic changes. It is the author's hope that these comments will help to clarify the situation regarding chlordane and relieve the anxiety of people who may have been alarmed by press reports.

76-2677. Hay, A. (Author address not given). **Toxic cloud over Seveso.** *Nature (London)* 262(5570): 636-638; 1976.

Various instances are reviewed in which the chemical TCDD (dioxin), an extremely toxic byproduct of trichlorophenol production, was released into populated areas and subsequently linked to severe illness, with emphasis on the July 10 explosion in a chemical factory in the North Italian town of Seveso. In this particular accident, trichlorophenol crystals and 2 kg of TCDD in the form of dust were precipitated south of the factory over an area inhabited by some two thousand people. The delay in establishing that TCDD had been released in the vapor cloud, and therefore the delay in urgent action being taken by local authorities, is severely criticized. The unacceptable location of an escape valve on the outside of the plant, leading to contamination of the surrounding area, is one of the major concerns under investigation. Decontamination procedures are mammoth in scope.

76-2678. McGinty, L. (Author address not given). **The graveyard on Milan's doorstep.** *New Sci.* 71(1014): 383-385; 1976.

Various incidences are reviewed in which accidental exposures to TCDD (dioxin) have caused grave injury. In particular the accident occurring at the plant in Seveso is recounted. The plant at Seveso manufactured 2,4,5-trichlorophenol, during which production TCDD is sometimes formed. Trichlorophenol is used to make two commercial substances, hexachlorophene and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T). The herbicide, 2,4,5-T, is known to cause birth defects such as cleft palates and kidney abnormalities in mice, while rats fed doses of 2,4,5-T as small as 4.6 mg/kg gave birth to progeny showing three times the incidence of kidney abnormalities in controls. The batches of 2,4,5-T used in the rodent testing which showed teratogenicity were later found to have been heavily contaminated by the known teratogen TCDD in concentrations of about 30 ppm. The EPA is planning public hearings on the question of whether the usefulness of 2,4,5-T outweighs its potential hazards.

76-2679. Matthews, G. A.; Clayphon, J. E. (Overseas Spraying Mach. Cent., Imperial Coll. Field Stn., Ascot, Berks., England). **Safety precautions for pesticide application in the tropics.** *PANS* 19(1): 1-12; 1973. (9 references)

Pesticides may enter the worker's body by three routes: by the mouth, through the lungs, or through the skin. Protective clothing should be worn by all persons engaged in pesticide application. The clothing should be light, and should be regularly washed with soap or detergent. Specific examples of such clothing are provided. Equipment design and methods of application are considered. First aid should be given when a person using pesticides becomes ill, but immediate medical attention by a doctor or at a hospital is also essential. The dangers involved in combining chemicals should be made known to farmers and others employed in applying these agents. Pesticide packaging and labeling requirements should call for warnings and other information to be printed in the language of the reader. General instructions which should be noted before applying pesticides and while mixing pesticides and during their application are listed.

76-2680. Gehlbach, S. H.; Williams, W. A. (Univ. North Carolina Sch. Med., Raleigh, NC). **Epidemiology of pesticide poisonings in North Carolina.** *Pediatr. Res.* 9(4): 297; 1975.

A review was made of 208 reported pesticide poisoning in children under 10 years of age from the records of the North Carolina Pesticides Program. The study revealed 48 symptomatic cases and 7 fatalities, with the mean age of the children being 27 months. Usually the exposure occurred during summer months, when pesticides are in heavy use. The anticoagulant rodenticides and organophosphate insecticides accounted for 16% each of the poisonings. Of those who ingested anticoagulants, none was symptomatic, but 76% of the children in contact with organophosphates became ill, and 3 died. Dermal absorption often followed contact with contaminated soil, "empty" containers, or sprayed rooms. Often the poison had been applied as food baits, a very attractive item to a child. It was found that petroleum distillates in many pesticides for home use offer a greater danger than the active ingredients. In spite of the toxicity of the pesticides as well as of their petroleum carriers, none of those currently marketed are required to have safety packaging.

76-2681. Hoffmann, D.; Wynder, E. L. (Naylor Dana Inst. Dis. Prevention, Amer. Health Foundation, Valhalla, NY 10595). **Smoking and occupational cancers.** *Preventive Med.* 5(2): 245-261; 1976. (105 references)

In this review of the epidemiological evidence linking tobacco smoking as a cofactor in occupational cancers is presented. It is noted, however, that in a large number of cases, information concerning the smoking habits of the patient is not available. The data available shows a lack of evidence for the joint action of occupational carcinogens and tobacco smoke. This finding particularly applies to workers in the chemical industries related to halo ethers, vinyl chloride, and certain urinary carcinogens. Synergistic and/or additive effects of occupational carcinogens and tobacco smoke may be regarded as established epidemiologically for some types of asbestos. Studies are needed in many areas where smoking can be directly viewed in relation to occupational carcinogens. The heavy cigarette smoker may very well to be the first affected by traces of carcinogens and will therefore give the first clue as to the occurrence of new cancer hazards.

76-2682. Bezuglyy, V. P.; Gorskaya, N. Z. (All-Union Scientific-Research Institute of the Hygiene and Toxicology of Pesticides, Polymers, and Plastics, Kiev, USSR). **Rol' kompleksa khlor- i fosfororganicheskikh pestitsidov v razvitii ateroskleroza.** [**The role of the complex of organochlorine and organophosphorus pesticides in the development of atherosclerosis.**] *Vrach. Delo* 2: 99-102; 1976. (15 references) (Russian)

In workers occupationally exposed to a combination of organochlorine and organophosphorus pesticides, the incidence of myocardial dystrophy was 56%, while it was 9.3% in a control group. EKG study of the pesticide workers revealed decreases in the S-T interval (in 24.1%) and in the voltage of the T wave (in 74.5%), as well as slowing of atrioventricular (in 4.6%) and intraventricular (in 17.4%) conduction. Autonomic vascular dystonia of the hypertensive type occurred in 18.4% of the pesticide workers and 0.9% of the controls, and the longer the period of service of the pesticide workers, the higher the frequency of increased arterial pressure. Clinical manifestations of aortal and coronary arterial atherosclerosis (II ischemic stage) were observed more often in pesticide workers than in the controls (in 17.9% vs. 6.9%), as were clinical manifestations of chronic coronary insufficiency (in 13.8% vs. 2.8%). The EKG of pesticide workers reflected this latter condition by a decrease in the S-T interval below the isoline (in 24.1% of the workers), a high pointed T wave (in 25.7%), and a negative and biphasic T wave (in 3.6%). The pulse wave distribution rate along elastic and muscular types of vessels was, respectively, 976.4 ± 19.14 mm/s and 897.3 ± 17.52 mm/s in the pesticide workers, and 753.6 ± 21.11 mm/s and 807.9 ± 17.59 mm/s in the controls. The vascular tonicity coefficient (muscular vessels/elastic vessels) was lower in the pesticide workers than in the controls (0.99 ± 0.0185 vs. 1.17 ± 0.0253), which indicated reduced vascular elasticity. The blood levels (in mg %) of cholesterol and of betalipoproteins were higher in the pesticide workers than in the controls (209.6 ± 9.7 vs. 178.3 ± 4.8, and 21.9 ± 1.0 vs. 17.02 ± 0.6), while the phospholipid level was reduced (189.5 ± 7.7 vs. 218.5 ± 1.8) and the phospholipid/cholesterol coefficient was significantly lower (0.99 ± 0.04 vs. 1.16 ± 0.07). The above findings suggest that the combination of organochlorine and organophosphorus pesticides may play a definite role in the development of atherosclerosis.

See also **76-2668** **76-2718** **76-2721** **76-2725** **76-2747**

76-2683. Salama, A. M.; Mostafa, I. Y.; El-Zawahry, Y. A. (Botany Dep., Fac. Sci., Cairo Univ., Egypt). **Insecticides and soil microorganisms.** *Acta Biol. Acad. Sci. Hung.* 26(1-2): 1-7; 1975. (12 references)

The fate of Dipterex (trichlorfon) was studied as affected by nodule-forming bacteria as well as by the roots of their host plants. Chromatographic analysis identified monomethyl- and dimethylphosphates as metabolites resulting from the enzymatic degradation of ^{14}C-labeled Dipterex in buffer solutions and root tissues of broad bean and clover plants, as well as in the culture media of *Rhizobium leguminosarum* and *Rhizobium trifolii*. It is suggested that the appearance of $^{14}CO_2$ liberated from rhizobial cultures containing radioactive Dipterex indicates that some of the methanol groups liberated during the breakdown of Dipterex are oxidatively degraded by the two *Rhizobium* spp.

76-2684. Dragsnes, L.; Helgeland, K. (Dep. Microbiol., Dental Fac., Univ. Oslo, Blindern, Oslo 3, Norway). **Effects of the herbicide 2,4,5-T on the incorporation of ^{14}C-thymidine, ^{3}H-uridine and ^{3}H-L-leucine into L 929 cells.** *Acta Pharmacol. Toxicol.* 36(2): 103-112; 1975. (21 references)

The effect of 2,4,5-T on the uptake and intracellular phosphorylation of ^{3}H-uridine has been studied using mouse fibroblasts from strain L 929, cultivated in Eagle's Minimum Essential Medium supplemented with 10% calf serum, penicillin, and streptomycin. Rapid inhibition of the incorporation of ^{3}H-L-leucine, ^{3}H-uridine, and ^{14}C-thymidine into the macromolecular fraction of L 929 cells was noted when 2.25 m*M* 2,4,5-T was added to the medium. The reduced incorporation of uridine and thymidine could be explained by an inhibitory effect on the uptake of 2,4,5-T on the uptake of these compounds into the acid-soluble precursor pool, whereas a direct effect on protein synthesis was indicated. Kinetic analysis of the uptake of uridine into the acid-soluble pool indicated that 2,4,5-T inhibited the facilitated transport of this nucleoside into the cell. The results suggest that 2,4,5-T induced alterations in the permeability of the cellular plasma membrane.

76-2685. Manninen, V.; Malkonen, M.; Skulskii, I. A. (Wihuri Res. Inst., SF-00140 Helsinki 14, Finland). **Elimination of thallium in rats as influenced by Prussian Blue and sodium chloride.** *Acta Pharmacol. Toxicol.* 39(2): 256-261; 1976. (11 references)

The effect of Prussian Blue on the elimination of radioactive thallium was studied in several organs of the Sprague-Dawley rat. The results of the study demonstrate the protective effect of Prussian Blue against lethal doses of thallium in rats. Treatment with Prussian Blue increased the survival of rats poisoned by 30 mg/kg thallium from 0 to 50%. The half-life of thallium was shortened drastically by Prussian Blue in all tissues studied, including the brain. Fecal excretion of thallium was increased about 3-fold. Thallium is secreted into the gut via bile and the intestinal mucosa. In the gut potassium ions in the lattice of the Prussian Blue molecule are exchanged for thallium. Retarded bowel function is a common finding in thallium poisoning and thus the elimination of thallium could be still further increased by the use of laxatives.

76-2686. Miller, D. S.; Kinter, W. B.; Peakall, D. B.; Risebrough, R. W. (Mount Desert Island Biol. Lab., Salsbury Cove, ME 04672). **DDE feeding and plasma osmoregulation in ducks, guillemots, and puffins.** *Amer. J. Physiol.* 231(2): 370-376; 1976. (29 references)

The mechanism of DDE impairment of nasal gland function was examined in mallards and white Pekin ducks maintained on freshwater and during exposure to 60-100% seawater. Experimental flocks had 10-250 ppm DDE added to mash before pelletization. No inhibition of nasal gland secretion was noted in freshwater- or seawater-maintained white Pekins. DDE had only minimal effects on plasma electrolyte levels and total nasal gland Na-K-ATPase activities in all species tested. DDE levels in the livers of experimental ducks and guillemots were comparable to those reported for seabirds found dead after kills. Levels in starved experimental puffins were much higher. It was concluded that DDE at environmental levels does not affect osmoregulation or nasal gland Na-K-ATPase in ducks or in two species of oceanic birds.

76-2687. Mollenhauer, H. H.; Johnson, J. H.; Younger, R. L.; Clark, D. E. (Vet. Toxicol. Entomol. Res. Lab., ARS, USDA, College Station, TX 77840). **A unique intracellular aberration related to hexachlorobenzene ingestion.** *Amer. J. Vet. Res.* 37(7): 847-850; 1976. (8 references)

A study was undertaken to examine the origin of hexachlorobenzene storage (HCB-S) vesicles in the livers of Sprague-Dawley rats fed HCB at levels of 1, 5, 10, and 25 ppm. The rats were fed the chemical over periods of 3 to 12 months. The HCB-S vesicles were present in the livers of more than half of the rats given HCB at levels of at least 5 ppm in their diets for periods of 3 months or longer. These vesicles ranged from about 0.1 to 3.0 m*m* in diameter. Typically they contained an amorphous matrix substance with small dense granules and electron-lucent blobs that gave them a uniformly mottled appearance. The change appeared as degeneration of lipid vesicles into a form of autophagic vacuole or storage vesicle. Degeneration of the lipid vesicles appeared to be by autodigestion, i.e., by endoplasmic reticulum encapsulation and partial digestion in the manner typical of other autophagic vacuoles. Although the function of HCB-S vesicles is speculative, it is suggested that they may be related to the elimination of fat-stored HCB.

76-2688. Maynert, E. W.; Hammond, B. G. (Dep. Pharmacol., Univ. Illinois, Chicago, IL 60680). **Modes of action of toxic agents.** *Ann. Clin. Lab. Sci.* 6(4): 322-331; 1976. (91 references)

The interactions of toxic agents with tissue constituents are discussed in relation to the type of chemical bond formed between the poison and the target. These bonds range in strength from weak ionic and van der Waals forces to strong covalent bonds. Toxic processes involving ionic or van der Waals forces include alteration of enzyme activity, interference with protein binding, intercalation with nucleic acids, alteration of electrolyte balance, alteration of the structure of water, and disorganization of cells. Some discussion is given to the reactions of heavy metals with tissue nucleophiles and of exogenous nucleophiles with tissue metals. Poisons can be covalently bound by the incorporation of an antimetabolite into a large molecule or reactions of electrophiles or free radicals with tissue constituents. Methyl bromide and organophosphate insecticides are included in the discussion of electrophile-macromolecule reactions.

76-2689. Munnecke, D. M. (Inst. Bodenbiol., Forsch. Landwirtsch., Braunschweig, Germany). **Enzymatic hydrolysis of organophosphate insecticides, a possible pesticide disposal method.** *Appl. Environ. Microbiol.* 32(1): 7-13; 1976. (20 references)

Parathion was hydrolyzed by a crude cell extract from a mixed bacterial culture growing on this insecticide at a rate of 416 nmol/min/mg protein. This enzymic hydrolysis rate was 2,450 times faster than chemical hydrolysis by 0.1 *N* sodium hydroxide at 40°C. Of 12 commonly used organophosphate insecticides, 8 were enzymatically hydrolyzed with this enzyme preparation at rates ranging from 12 to 1,360 nmol/min/mg protein. Seven pesticides were hydrolyzed at rates significantly higher (40 to 1,500 times faster) than chemical hydrolysis. For enzymic hydrolysis the pH optimum was from 8.5 to 9.5, with less than 50% of maximal activity expressed at pH 7.0. Maximal enzyme activity was noted at 35°C. The activity of the crude extract was lost at the rate of only 0.75%/day when stored at 6°C. Enzymatic hydrolysis was stimulated to the extent of 3 to 20% by eight organic solvents, ranging from methanol to hexane, at low concentrations. At higher concentrations (1,000 mg/liter) they inhibited the reaction 9 to 50%. The parathion metabolite *p*-nitrophenol as well as hydroquinone and diethylthiophosphoric acid at up to 100-mg/liter concentrations did not significantly influence enyzme activity.

76-2690. Hicks, G. F., Jr.; Corner, T. R.* (Dep. Microbiol. Pub. Health, Michigan State Univ., East Lansing, MI 48824). **Distribution and effects of 2,4,5-trichlorophenoxyacetic acid in cells of *Bacillus megaterium*.** *Appl. Microbiol.* 30(6): 959-963; 1975. (11 references)

Cell death in a resting population of an asporogenous *Bacillus megaterium* was accelerated by ambient concentrations of 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) equal to or greater than 10 μg/ml. Effects on cell respiration were not manifest until the ambient concentration reached 1,000 μg of 2,4,5-T/ml, or 500 μg/mg. Cells of *B. megterium* did, however, accumulate 2,4,5-T passively to a level approximately twofold above the ambient concentration. Most of the accumulated compound was easily washed from the cell but, of the firmly bound herbicide, about 0.5 μg/mg of cells (dry weight), nearly 60% by weight, was localized in the protoplast membrane. The foregoing results, obtained with a purified preparation of 2,4,5-T were also elicited by 2,4,5-T analytical standards. The extracted contaminants did not produce the results alone nor did they influence the results when present in combination with 2,4,5-T. (Author abstract by permission)

76-2691. Steinberg, G. M.; Amshey, J. W., Jr. (Biochem. Group, Biomed. Lab., Edgewood Arsenal, MD 21010). **Comparison of the effect of the reversible inhibitor hexamethylenebis- [dimethyl- (3-phthalimidopropyl) ammonium bromide] upon the hydrolysis of several substrates by acetylcholinesterase: additonal evidence for the existence of substrate and modifier sites.** *Arch. Biochem. Biophys.* 175(2): 618-626; 1976. (26 references)

This study provides evidence for the existence of one or more regulatory sites on the enzyme acetylcholinesterase. The characteristics of the inhibition of acetylcholinesterase by hexamethylenebis [dimethyl- (3-phthalimidopropyl) ammonium bromide] (PTP) are both qualitatively and quantitatively different when examined in the presence of the substrates acetylcholine and phenyl acetate. When interpreted in terms of the Rosenberry and Bernhard model for acetylcholinesterase catalysis, a model which involves specific regulatory and inhibitory sites on the enzyme, the results of this study support this model. Perturbation of the enzyme via such regulatory sites may provide new approaches to prophylaxis and therapy for poisoning by anticholinesterase compounds. PTP at 26 μ*M* reduces the rate at which sarin inhibits AChE by approximately 35%. Similar rates of reduction are noted for phenyl acetate and ACh turnover. Thus PTP cannot be said to selectively inhibit the phosphonylation reaction.

76-2692. Karel, A. K. (Toxicol. Lab., Dep. Zool., L.B.S. Coll. Sci., Tilak Nagar Jaipur, India). **Acute chlordane toxicity on the serum alkaline phosphatase activity of *Meriones hurrianae* Jerdon.** *Arch. Internatl. Physiol. Biochem.* 84: 63-68; 1976. (17 references)

The effects of chlordane were studied on the serum alkaline phosphatase activity in *Meriones hurrianae* Jerdon, the Indian desert gerbil. Each animal received 0.2 ml of 1.0% (25 mg/kg body weight) chlordane administered by intramuscular injection in the thigh. Animals were autopsied 1, 2, 3, 7, 14, 21, and 28 days after treatment. In additional experiments, animals received 0.2 ml of 2.0% (50 mg/kg) and 3.0% (75 mg/kg) chlordane. The serum alkaline phosphatase level was raised significantly in gerbils treated with different doses of chlordane. An initial increase in serum alkaline phosphatase was followed by a

decrease approaching control values within four weeks after treatment. The effect was more pronounced in gerbils treated with higher concentrations. The increase in serum alkaline phosphatase level may be attributed to the degeneration and necrosis of parenchymal cells and to microsomal enzyme induction in parenchymal cells of liver as a result of chlordane treatment.

76-2693. Puga, F. R.; La Regina Rodrigues, M. A. (Inst. Biol., Sao Paulo, Brazil). **Efeito de inseticidas sobre o metabolismo e a susceptibilidade de celulas IB-RS-2 ao virus da febre aftosa. [Effect of insecticides on metabolism and susceptibility of IB-RS-2 cells to foot-and-mouth disease virus.]** *Arq. Inst. Biol. Sao Paulo* 41(3): 141-145; 1974. (7 references) (Portuguese)

The effects of dimethoate and propoxur on IB-RS-2 cells and on foot-and-mouth disease virus multiplication were studied. Cell growth was stimulated and the level of cellular proteins was increased by dimethoate. However, the DNA level remained unchanged. These effects were dependent on the concentration of the pesticide and length of exposure time. A 52% increase in the yield of foot-and-mouth disease virus was noted in cells exposed to dimethoate. No significant changes were noted on cellular levels of proteins and nucleic acids nor on the yield of foot-and-mouth disease virus in IB-RS-2 cells exposed to propoxur.

76-2694. Schoene, K.; Steinhaunses, J.; Oldiges, H. (Inst. Aerobiol., Fraunhofer-Gesellschaft, Schmallenberg-Grafschaft, Germany). **Protective activity of pyridinium salts against soman poisoning in vivo and in vitro.** *Biochem. Pharmacol.* 25(17): 1955-1958; 1976. (18 references)

The protective effects of a series of pyridinium salts against soman poisoning were studied using female mice. From the most active compound, 130 nmoles/kg (i.m.) reduced the toxic effect of a LD95 of soman (s.c.) down to the 50 per cent mortality level. The compounds with protective activity in vivo were able to protect acetylcholinesterase (AChE) from soman in vitro. The protective efficiency was evaluated by comparing the rates of AChE inhibition in the absence and in the presence of 1 m*M* pyridinium salt. The most effective substances decreased the inhibition rate down to about 1/100 of the unprotected value. Additionally, the influence of these compounds upon the acetylcholine hydrolysis by AChE was investigated. A striking correlation exists between the protective efficiencies in vitro and the competitive inhibition constants of the pyridinium salts.

76-2695. Tsang, B. K.; Kacew, S.; Singhal, R. L. (Dep. Pharmacol., Fac. Med., Univ. Ottawa, Ottawa, Ontario, Canada). **Possible involvement of cyclic AMP-dependent protein kinase in *p,p'*-DDT-induced changes in hepatic metabolism.** *Biochem. Pharmacol.* 25(17): 1985-1989; 1976. (42 references)

Administration of an acute dose of *p,p'*-1,1,1-trichloro-2,2-bis (*p*-chlorophenyl) ethane (*p,p'*-DDT) (600 mg/kg, p.o.) resulted in a significant increase in hepatic adenylate cyclase activity (40%) and endogenous cyclic AMP levels (31%). Although the cytosol cyclic AMP-independent protein kinase activity was only slightly affected (18 %), the activity of the nucleotide-dependent enzyme was significantly decreased to 74% of the control values. Whereas the protein kinase activity ratio (- cyclic AMP/+cyclic AMP) of this soluble enzyme was increased, the ability of the enzyme to bind [$\geq\eta$]cyclic AMP in vitro was significantly decreased after pesticide administration. As observed with the soluble enzyme, maximal stimulation of the crude nuclear protein kinase (1500 g pellet) was observed 1 hr after *p,p'*-DDT treatment, as indicated by changes in the phosphorylation of endogenous nuclear substrates and cyclic AMP-binding capacity. Studies with lower dosages of DDT revealed that a dose as low as 100 mg/kg was sufficient to produce statistically significant alterations in the activities of both the soluble and particulate enzymes. In most cases, doubling the dosage (200 mg/kg) resulted in greater changes in these biochemical parameters. The present study supports the concept that the DDT-induced alterations in hepatic carbohydrate metabolism may be related to an initial simulation of the hepatic AMP-adenylate cyclase-protein kinase system.

76-2696. Heisinger, J. F.; Green, W. (Dep. Biol., Univ. South Dakota, Vermillion, SD 57069). **Mercuric chloride uptake by eggs of the ricefish and resulting teratogenic effects.** *Bull. Environ. Contam. Toxicol.* 14(6): 665-673; 1975. (25 references)

The teratogenic effects of inorganic mercury on fish embryos and the ability of fish embryos to concentrate inorganic mercury directly from water were studied. Japanese Medaka, *Oryzias latipes*, were used in this study. The experimental embryo rearing solutions contained 10 ppb, 15 ppb, or 30 ppb of inorganic mercury. The hatching rate for the 10 ppb experimental eggs was 58.3%, which is not significantly different from controls. At 15 ppb the hatching rate was 20.8%, and none of the 20 or 30 ppb eggs hatched. Fry hatched from the 15 ppb exposed eggs appeared to lack ability to move their caudal fins. Pectoral fins moved rapidly. The fish remained on their sides on the bottoms of the petri dishes. Their tails were bent in an anterior and ventral direction, assuming a "C"-shaped position. Hemorrhaging blood vessel deterioration, and loss of circulating blood cells were noted in the 79% of the 15 ppb experimental eggs which did not hatch. Those which did hatch appeared normal in these respects. The 10, 15, 20, and 30 ppb experimental eggs concentrated mercury directly from the incubating solution 1,600, 1,900, 2,700, and 1,900 times, respectively. The total concentration of mercury in these eggs after 16 consecutive days was 16,000, 29,000, 54,000, and 56,000, respectively.

76-2697. Strange, J. R.; Allred, P. M.; Kerr, W. E. (Sch. Biol., Georgia Inst. Technol., Atlanta, GA 30332). **Teratogenic and toxicological effects of 2,4,5-trichlorophenoxyacetic acid in developing chick embryos.** *Bull. Environ. Contam. Toxicol.* 15(6): 682-688; 1976. (11 references)

2,4,5-T in DMSO (12.5-156.25 mg 2,4,5-T/kg) or acetone (25-150 mg/kg) was injected into the air space of Shaver-Starcross-White Leghorn chick eggs. In some cases, 2,4,5-T (50-250 mg/kg) in DMSO was injected a second time 5 days later. The LD50 for 2,4,5-T injected on the fifth day of incubation was 68 mg/kg. The herbicide's toxicity may have been synergistically enhanced by DMSO. The LD50 for herbicide injected in DMSO on day zero of incubation was 62 mg/kg, while the LD50 for herbicide in acetone was 133 mg/kg. DMSO alone had no effect on egg hatchability at concentrations up to 100 mg/kg, but at 250 mg/kg it caused 100% mortality. A teratogenic evaluation produced no clear results. The data indicates that, while 2,4,5-T is clearly toxic to developing chick embryos, it is toxic only at levels greatly exceeding those occurring following application at recommended rates.

76-2698. Chernoff, N.; Carver, B. D. (Exp. Biol. Div., Health Effects Res. Lab., U.S. EPA, Environ. Res. Cent., Research Triangle Park, NC 27711). **Fetal toxicity of toxaphene in rats and mice.** *Bull. Environ. Contam. Toxicol.* 15(6): 660-664; 1976. (10 references)

Toxaphene was administered by gastric intubation at doses of 15-35 mg/kg/day to pregnant CD-1 mice and CD rats during the period of organogenesis (days 7-16 of gestation). The mice and rats were killed on days 18 and 21 of gestation, respectively. Among rats receiving the highest dose, there was a 31% maternal mortality rate. There were also dose-related effects on fetal mortality or anomalies. In the mice, the highest dose produced an 8% maternal mortality rate. There was also a dose-related reductions in maternal weight gain, fetal weight, and average number of sternal and caudal ossification centers. There were no dose-related reduction in maternal weight gain and an increase in maternal liver/body ratio. Five litters from animals receiving the highest dose of toxaphene had at least one offspring with encephaloceles. Thus toxaphene administration to rats and mice during the period of embryonic organogenesis results in some fetotoxic effects at levels which cause maternal toxicity.

76-2699. Geike, F.; Parasher, C. D. (Inst. Pflanzenschutzmittelforsch., Biol. Bundesanst. Land-Forstwirtsch. D-1000 Berlin-Dahlem, Germany). **Effect of hexachlorobenzene on some growth parameters of *Chlorella pyrenoidosa*.** *Bull. Environ. Contam. Toxicol.* 15(6): 670-677; 1976. (16 references)

Chlorella pyrenoidosa was incubated with HCB (0.001-10.0 ppm) in a "light-thermostat" at 30°C for 46 hr with continuous light (4000 Lux) and aeration. HCB decreased algal growth as deduced from measurements of chlorophyll content, dry matter, carbohydrate content, and total nitrogen. Incubation with 0.1 and 1.0 ppm HCB for 3 mo in Erlenmeyer flasks under daylight conditions resulted in an increase n chlorophyll over control values. Following transfer of the cultures from the Erlenmeyer flasks to "light-thermostat" growth conditions, algal growth was greatly enhanced by HCB at all concentrations; the greatest increase was observed with 0.1 ppm.

76-2700. Gupta, P. K. (Ind. Toxicol. Res. Cent., Lucknow, India). **Endosulfan-induced neurotoxicity in rats and mice.** *Bull. Environ. Contam. Toxicol.* 15(6): 708-713; 1976. (6 references)

Adult male and female ITRC rats and mice were injected i.p. with varying amounts of endosulfan dissolved in different vehicles. Rats were more resistant than mice and males were more resistant than females to the toxic effects of endosulfan. In both species, the LD50 for endosulfan in alcohol was about 50% less than that of endosulfan in ground nut oil. Signs of intoxication included hyperresponsiveness to tactile stimuli, tremors in the forelimbs and later throughout the body, and increased respiration followed by respiratory depression. At a single dose of endosulfan, the time until death and severity of symptoms in the rats varied from animal to animal. No definite gross pathological lesions were observed in any of the animals. At 60 mg/kg, endosulfan significantly decreased the brain acetylcholinesterase activity in the female rats.

76-2701. Ogilvie, D. M.; Miller, D. L. (Dep. Zool., Univ. Western Ontario, London, Ontario, Canada). **Duration of a DDT-induced shift in the selected temperature of Atlantic salmon (*Salmo salar*).** *Bull. Environ. Contam. Toxicol.* 16(1): 86-89; 1976. (8 references)

Groups of five underyearling Atlantic salmon (*Salmo salar*, Linn.) were exposed for 24 hr to 50 ppb DDT or the same amount of the acetone carrier. The fish were tested simultaneously in a multichannel thermogradient device at various intervals over the next 7 wk. Control salmon had a mean selected temperature of 19.1°C, whereas DDT exposed fish had a mean selected temperature of 23.4°C; the difference was hightly significant. The pesticide-induced elevation in selected temperature was evident immediately after exposure and for 1 mo thereafter, but was not evident 6 and 7 wk after exposure. There was a rough agreement between the time required to achieve a significant reduction in the level of DDT in other species of fish following a single acute exposure and the time required for temperature selection in DDT-exposed salmon to return to normal.

76-2702. Makhija, S. J.; Pawar, S. S. (Biochem. Div., Chem. Dep., Marathwada Univ., Aurangabad, Maharashtra, India). **Effects of atropine sulphate treatment**

on hepatic mixed function oxidase system during Baygon intoxication. *Bull. Environ. Contam. Toxicol.* 16(1): 90-97; 1976. (15 references)

Young male and female CF rats were injected ip for 2 successive days with Baygon (propoxur, 10 mg/kg/day) or atropine sulfate (5 mg/kg/day). Other animals were treated with Baygon for 2 days followed by atropine sulfate for 2 days or vice versa. The animals were sacrificed 24 hr after the last injection. The effects of the treatments on relative liver weight, 9000*g* supernatant protein, and hepatic microsomal protein varied according to sex and the other in which the drugs were given. Drug metabolizing activities were decreased by Baygon and most were decreased by atropine sulfate. Baygon plus atropine sulfate increased drug metabolizing activities in most cases, although there were some sex differences, and both aniline and acetanilide hydroxylase activities were decreased. The effects on cytochrome b_5, cytochrome c reductase, heme and microsomal pyridine binding spectra varied according to treatment and sex.

76-2703. Juszkiewicz, T.; Kosmala, K.; Zmudzki, J. (Dep. Pharmacol. Toxicol., Vet. Res. Inst., Pulawy, Poland). **Trichlorfon residues in milk following dermal application of Neguvon (Bayer) against *Hypoderma bovis*.** *Bull. Vet. Inst. Pulawy* 18(3-4): 93-96; 1974. (12 references)

Determinations of trichlorfon in milk from dairy cow which had been given Neguvon as an agent against *Hypoderma bovis* larvae were carried out. The cows were given a dose equal to 50 mg of trichlorfon per 1 kg body weight after the afternoon milking. Milk samples were taken at 6, 16, 24, 30, 40, and 48 hr after administration. Gas chromatography was used for determining trichlorfon residues. The highest mean concentration of trichlorfon was found 16 hours after dosing, and it was 0.157 ppm. The concentration gradually decreased and after 48 hr it was only 0.029 ppm. The range of concentrations after 48 hr was 0.014-0.044 ppm and the FAO/WHO recommendations for trichlorfon concentration in milk are that it should not exceed 0.05 ppm. Therefore it was concluded that the 48 hour period after application be the period allowable for reduction of trichlorfon residues to values lower than those recommended.

76-2704. Higginson, J.; Terracini, B.; Agthe, C. (Internatl. Ag. Res. Cancer, Lyon, France). **Nutrition and cancer: ingestion of foodborne carcinogens.** *IN: Cancer Epidemiology and Prevention.* Edited by D. Schottenfeld Ed., Charles C. Thomas, Springfield, IL, 1976, p. 177-206.. (221 references)

Various potential carcinogens have been and still are present in the human diet and therefore are presumably ingested. Contamination of food by pesticides may occur directly or indirectly. Specific deleterious effects of DDT, aldrin and dieldrin, chlorbenzilate, benzene hexachloride (BHC), mirex, heptachlor, methoxychlor, strobane, carbon tetrachloride, pentachloronitrobenzene (PCNB), maleic hydrazide, amitrole, aramite, and thiourea are discussed. These are pesticides which have given at least one positive result in animal testing. Other pesticides given concern as possible carcinogenic hazards include captan and dichlorvos. in view of the fact that goitrogenicity is related to carcinogenicity, the dithiocarbamates which are being increasingly used create some concern, as they have strong goitrogenic effects on laboratory animals and on man. In view of the long latent period of many cancers and the lack of epidemiological data, it is almost impossible to state with certainty that any ingested chemical is safe, and thus continuous monitoring is necessary.

76-2705. Wattenberg, L. W. (Dep. Lab. Med. Pathol., Univ. Minnesota Sch. Med., Minneapolis, MN 55455). **Effects of dietary constituents on the metabolism of chemical carcinogens.** *Cancer Res.* 35(11): 3326-3331; 1975. (58 references)

The metabolism of chemical carcinogens has been shown to be influenced by dietary constituents of 2 types. Naturally occurring inducers of increased activity of the microsomal mixed-function oxidase system are present in plants. Cruciferous vegetables are particularly potent in this regard. From Brussels sprouts, cabbage, and cauliflower, 3 indoles with inducing activity have been identified: indole-3-acetonitrile, indole-3-carbinol, and 3,3′-diindolylmethane. A second type of dietary constituent which affects the microsomal mixed-function oxidase system is added phenolic antioxidants, butylated hydroxyanisole (BHA) and butylated hydroxytoluene. The feeding of BHA has resulted in microsomal changes in the liver. Spectral characteristics of cytochrome P-450 were changed, and the aryl hydrocarbon hydroxylase system of these microsomes demonstrated increased sensitivity to inhibition by α-naphthoflavone. A decrease in the binding of metabolites of benzo(a)pyrene to DNA was noted upon incubation of these microsomes with benzo(a)pyrene. Several studies have demonstrated that increased levels of activity protect against administration of chemical carcinogens. BHA and butylated hydroxytoluene exert a protective effect against chemical carcinogens. Thus it is concluded that the constitutents of the diet could be of consequence in the neoplastic response to exposure to carcinogens in the environment. A number of insecticides and polychlorinated biphenyls are inducers of aryl hydrocarbon hydroxylase, and contamination of the diet with these compounds could enhance mixed function oxidase activity.

76-2706. Seifert, J.; Vacha, J. (Inst. Pharmacol., Czechoslovak Acad. Sci., Prague, Czechoslovakia). **The biosynthesis of cytidine nucleotides and the level of cytochrome P-450 in rat liver after administration of α-hexachlorocyclohexane.** *Chem.-Biol. Interactions* 13(3-4): 359-363; 1976. (16 references)

This paper describes the time course of changes in the utilization of (2-^{14}C)orotic acid in the synthesis of cytidine components of the acid-soluble pool, in liver rRNA and DNA and in levels of cytochrome P-450 after administration of α-HCH (α-BHC). Male Wistar rats received α-HCH orally at 100 mg/kg in olive oil. (2-^{14}C)orotic acid was injected intraperitoneally. This single administration of α-HCH did not affect liver weight up to 54 hr after application. The radioactivities of rRNA uridylic acid increased from the 3rd hour after administration of the drug and remained constant for the entire period of observation. Radioactivity of rRNA cytidylic acid decreased after the 5th hour and decreased further throughout the experiment. Similar changes were noted in the pyrimidine components of the acid-soluble pool. Biosynthesis of cytidine nucleotides decreased after 5 hr and continued to decrease throughout the study. Levels of cytochrome P-450 in microsomes did not change in 7 hr after administration, but rose later. Utilization of (2-^{14}C)orotic acid for cytidine nucleotide synthesis of DNA was depressed during the initial intervals after α-HCH administration. After 23 hr there was an increase, while later the specific radioactivity again decreased. It is suggested that the changes in the cytidine nucleotide biosynthesis of the liver may be connected with alterations in biosynthesis of microsomal phospholipids after α-HCH administration.

76-2707. Landrum, P. F.; Pollock, G. A.; S ber, J. N.; Hope, H.; Swanson, K. L. (Dep. Environ. Toxicol., Univ. California, Davis, CA 95616). **Toxaphene insecticide: identification and toxicity of a dihydrocamphene component.** *Chemosphere* 5(2): 63-69; 1976. (10 references)

The isolation, identification, and some properties are presented of the first toxaphene component known to retain the ring structure of camphene, 2,5,6-*exo*- 8,8,9,10-heptachloro dihydrocamphene. Mouse LD50s were determined by i.p. injection in MDSO using male Swiss Webster strain mice; housefly (*Musca domestica*) LD50 were determined by topical administration in acetone using WHO susceptible UCR strain. The amount of the compound available was insufficient to determine its mouse toxicities. The mouse LD50 of the seventh column (adsorption chromatography) fraction, of which this compound constitutes about half by weight, was twice that of toxaphene. The compound studied did not differ significantly from toxaphene itself in its toxicity to the housefly.

76-2708. D'Souza, A. V.; Batra, B. K. (Entomology Div., Cancer Res. Inst., Tata Mem. Ctr., Parel, Bombay, India). **A study of the effects of DDVP (propoxure) [*sic*] on laboratory mouse.** *Curr. Sci.* 45(10): 377-379; 1976. (10 references)

Visibly pregnant female C57bl and Swiss/ICRC mice were kept in cages which were sprayed weekly with DDVP (presumably dichlorvos, 2.1-2.4 g/cage). The treatments were discontinued for 2 wk after delivery and resumed after weaning for a period of 8 (offspring) or 10 (mothers) mo. After 3 mo of treatment, the mothers developed ruffled hair, breathing difficulties, diarrhea, and weakness; premature death and partial or complete sterility were observed after longer periods of treatment. Sterility was common among the offspring, especially the C57 animals. Histologically, the testes of the treated males contained large vacuoles resulting from deletion of seminiferous tubules. Many tubules lacked germ cells, cryptorchism was common, and two mice developed testicular tumors. The ovaries of the treated females were hyalinized and the follicles and oocytes were absent in many animals. DDVP spray caused sterility in the mouse by producing drastic abnormalities in the reproductive systems.

76-2709. Prahlad, K. V.; Anderson, R. J. (Dep. Biol. Sci., Northern Illinois Univ., DeKalb, IL 60115). **Deleterious changes induced by the fungicide ethylenebis (dithiocarbamic acid) disodium salt (nabam) and the herbicide 1,1′-ethylene-2,2′-dipyridinium dibromide (diquate) in *Xenopus laevis* embryonic tissues: an ultrastructural study.** *Cytobios* 14(53): 63-74; 1975. (13 references)

Studies were undertaken to determine the nature of ultrastructural changes in *Xenopus laevis* embryos treated with low concentrations of a mixture of nabam (2 ppm) and diquat (1 ppm). Experimental animals showed stunting, a wavy notochord, and disrupted myomeres and myocommata. Development of muscle fibers was inhibited, with a disorganized state of the few which had differentiated. Collagen fibers in the myocommata were sparse and in disarray. Large deposits of glycogen were noted between mitochondria in the extra-fibrillar sarcoplasmic reticulum. As similar effects were not noted in individuals treated with either of the pesticides at the dosages used in combination experiments, it is concluded that these alterations reported are due to the synergistic actions of the two pesticides. Therefore, this suggests that pesticides which are not extremely harmful when administered alone in low concentrations may induce deleterious changes when used simultaneously.

76-2710. Petrova, V. S. (S. N. Vyshelesskiy Beloruss. Res. Inst. Exp. Vet., USSR). **Vlyaniye malykh doz valeksona na organizm telyat. [The effect of low doses of valexon (phoxim) on calves.]** *Dokl. Akad. Nauk BSSR* 20(3): 269-271; 1976. (9 references) (Russian)

The effect of 2.6, 0.26, and 0.052 mg/kg of valexon in the feed 9-12 month-old black-piebald calves was studied for 3 months. The general state of the animals, body temperature, pulse rate, respiration and weight gain remained normal. In the animals receiving 2.6 mg/kg, lymphopenia and an increase in hemoglobin and erythrocyte levels were noted. At the highest dose serum cholinesterase activity (38.8 ± 2.5%) was inhibited after 2 months, with erythrocyte acetylcholinesterase activity reaching a minimum after 3 months. Alkaline phosphatase levels in-

creased with the highest valexon dose, reaching a maximum in the 2nd month (204.3% of control). No changes were noted in blood serum protein and protein fractions or in the morphology of internal organs.

76-2711. Blase, B. W. (Univ. Washington, Seattle, WA 98105). **The uptake and metabolism of carbaryl by mammalian lung.** *Diss. Abstr. Int. B* 37(2): 718-719; 1976.

The present study was done by measuring the uptake and metabolism of carbaryl in the lungs of two species of mammals. Two basic preparations were used in this study—the chopped rat lung and the isolated perfused rabbit lung. It was concluded that uptake in both preparations was by simple diffusion alone. Carbaryl uptake in 15 minutes amounted to 15% of the dose in the chopped rat lung and 26% of the dose in perfused rabbit lung. After 15 minutes at 80 μg/ml of carbaryl, 2.5% of the dose in the chopped rat lung and 22.6% in the perfused rabbit lung was metabolized. A number of inhibitors were tested for their effects in these two preparations. Ouabain (0.1 μM) had no statistically significant effect on uptake or metabolism in either preparation. SKF525A had no significant effect on carbaryl uptake or metabolism in the chopped rat lung. In the perfused rabbit lungs, SKF525A was highly toxic at a concentration of 1.8 μM. A mixture of cyanide (10 μM) and iodoacetate (10 μM) was found to significantly decrease the uptake and metabolism of carbaryl in chopped rat lung. Analysis of the dichloromethane extracts of perfusate and lung tissue using high pressure liquid chromatography revealed the presence of the carbaryl metabolites, 4-hydroxycarbaryl and α-naphthol. A number of unresolved peaks were also seen. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 76-17,407.)

76-2712. Lehotzky, K. (Orszagos Munka- es Uzemegeszsegugyi Intezet, Budapest, Hungary). **Kemiai anyogok primer borirritacios hatasanak experimentalis vizsgalata. [Experimental study of the primary skin-irritating effect of chemical agents.]** *Egeszsegtudomany* 20(1): 94-97; 1976. (5 references) (Hungarian)

The skin irritating effects of different chemical preparations were studied by Draize's method on albino rabbits and by Uttley's method on albino mice. The Draize index was determined to be 5.8 for Nitanil 60 WP (a preparation containing chlorbromuron), 2.4 for Furadan I (2-hydroxyphenylmethallyl ether), 4.8 for Furadan II (2,3-dihydro- 2,2-dimethyl- 7-benzofuranol), 4.3 for TA-4 (2,4-dichloro- 6-aminophenyl- 1,3,5-triazine), 4.0 for FCI-4 (sodium 2,4-dichloro- 6-aminophenol- 1,3,5-triazine- 4-sulfonate), and 0 for ABEM (2-carbamethoxyamino benzimidazole). The Uttley indices were 31 for Natanil 60 WP, 5.0 for Furadan I, 14.5 for Furadan II, 7.6 for TA-4, 6.1 for FCI-1, and 0 for ABEM. The findings indicate that the combination of the two methods in both species yields more reliable data on the skin irritating effects of chemical substances than either of the methods taken separately.

76-2713. Strateva, A. (Joint Res. Inst. Hyg., Ind. Prot. Occup. Dis., Sofia, Bulgaria). **Amidni preparati s kherbitsidno deystvie. Eksperimentalni danni v''rkhu ostrata oralna toksichnost na propakhlora (ramroda). [Amide preparations with herbicidal action: experimental data on acute oral toxicity of propachlor (ramrod)]** *Eksp. Med. Morphol.* 13(2): 123-129; 1974. (10 references) (Bulgarian)

The LD50 for orally administered propachlor in rats was 950 (860-1050) mg/kg; in mice 290 (240-350) mg/kg; and in rabbits 392 (272-565) mg/kg. Propachlor affected the nervous system, with the highest doses inducing symptoms within 5 min and death within 2-3 hr. Animals which died within 24 hr had circulatory changes in all internal organs, particularly the lungs. Parenchymatous dystrophic changes were found in the liver and kidneys of animals receiving lower doses that were sacrificied on the 14th day. A decrease was noted in succinate dehydrogenase, alkaline and acid phosphatase, monoamine oxidase, cytochrome oxidase, serum glutamic-oxaloacetic transaminase, and glucose-6-phosphatase activity and in hemoglobin levels. Serum glutamic-pyruvic transaminase levels increased.

76-2714. Surak, J. G.; Bradley, R. L., Jr. (Dep. Food Sci., Univ. Wisconsin, Madison, WI 53706). **Transport of organochlorine chemicals across cell membranes.** *Environ. Res.* 11(3): 343-352; 1976. (26 references)

A study was conducted to determine the means of transport of DDT, an organochlorine chemical, across cell membranes. As DDT is relatively insoluble in water, soluble in organic solvents, and exhibits only a partial ionic charge, it was assumed that it would behave like a lipophilic drug. ^{14}C-labeled-DDT was absorbed into mixed lipid micelles during the digestion of olive oil by pancreatic lipase. Sephadex chromatography showed that taurocholic acid and ^{14}C-DDT combined, forming a mixed micelle. Apparently, incorporation of DDT in mixed micelles represents the mode of intestinal absorption. This was demonstrated by the uptake of these micelles using an everted gut sac technique. In aqueous solution, ^{14}C-DDT acted like a lipophilic drug in that it was passively transported across the cell walls of intestinal and mammary tissue. No inhibition of ^{14}C-labeled DDT uptake was noted when $HgCl_2$, KCN, or Na azide was added to the incubation solution. Competitive inhibition was also not noted when TDE was added to the medium.

76-2715. Meiniel, R. (Lab. Biol. Anim., Univ. Clermont, Aubiere, France). **Pluralite dans le determinisme des effets teratogenes des composes organophosphores. [Plurality in the determinism of organophosphorus compounds' teratogenic effects.]** *Experientia* 32(7): 920-922; 1976. (20 references)

In quail embryos, nicotinamide prevents beak and leg abnormalities produced by bidrin (dicrotophos) but remains ineffective against vertebral defects induced by bidrin and parathion. In contrast, the vertebral deficiencies are greatly alleviated or abolished by pralidoxime, an antidote known and used in organophosphorus intoxications. From these observations, a plurality in the determinism of teratogenic effects induced by organophosphorus compounds is evident. (Author abstract by permission)

76-2716. Egert, G.; Greim, H.* (Abt. Toxikol., Gesellsch. Strahlen Umweltforsch., Neuherberg, Germany). **Formation of dimethylnitrosamine from pesticides carrying methylated tertiary aminogroups in the presence of nitrite at pH 3.** *Food Cosmet. Toxicol.* 14(3): 193-195; 1976. (18 references)

Pesticides and nitrite present in human food may be a hazard to man, since many pesticides are secondary or tertiary amines, which are known to form nitroso compounds in the presence of nitrite under conditions resembling those in the human stomach. Four tertiary amine pesticides—two dimethylurea derivatives, one thiuram disulphide, and one phosphine compound—were incubated for 4 hr at 37°C in the presence of excess nitrite at pH 3. The reaction products were extracted with dichloromethane and were analyzed qualitatively and quantitatively by infrared spectrophotometry, nuclear magnetic resonance spectrometry, gas chromatography—mass spectrometry, and light spectrometry. All four pesticides formed carcinogenic dimethylnitrosamine, the yields obtained being cycluron 4%, chloroxuron 3%, thiram 9%, and dimefox 22%. (Author abstract by permission)

76-2717. Sokolova, L. A. (Saratov Sci. Res. Inst. Rural Hyg., Saratov, USSR). **Izucheniye vliyaniya gerbitsida 2,4-DM na beremennyy organizm, embrion al'noye razvitiye i funktsiyu gonad belykh krys. [Study of the effect of the herbicide 2,4-DB on pregnant females, embryonal development, and gonadal function in albino rats.]** *Gig. Sanit.* 41(2): 20-23; 1976. (3 references) (Russian)

Administered orally at a dose of 3.4 mg/kg/day over the course of pregnancy, 2,4-DB had an insignificant toxic effect on pregnant female rats, which was manifested by an increased ascorbic acid level in the brain. This dose may be considered the threshold dose for pregnant females. Investigation of the effect of a single oral administration of 2,4-DB in a dose of 1/5 LD50 (416 mg/kg) at various periods of pregnancy (4th, 5th, 7th, 9th, 10th, 11th, and 14th days) indicated that at all times the embryo was sensitive to the herbicide. This was evidenced by higher frequencies of preimplantation death (herbicide exposure on the 4th and 5th days) and postimplantation death (exposure on the 9th day), and decreased birth size (exposure on the 4th, 5th, 10th, 14th days). Period administration of 2,4-DB throughout pregnancy in doses of 3.4, 1, and 0.1 mg/kg did not increase the embryonal death rate, but the 3.4 mg/kg dose increased the number of young per litter and decreased birth size, while the 1 mg/kg dose increased the frequency of hemorrhages into the abdominal cavity. The number of stillborns was 19% in females given the 3.4 mg/kg dose, as opposed to 2.4% in controls. The effects of the 3.4 mg/kg dose on the progeny was reflected by a stimulated weight gain, decreased nervous system excitability, intensified hepatic detoxoifying function, decreased cardiac weight coefficient, and altered peripheral blood composition. The 1 mg/kg dose also stimulated weight gain reduced the nervous system excitability, and altered the peripheral blood composition of the progeny, as well as decreasing the liver ascorbic acid level and increasing the ovarian weight coefficient. The progeny of mothers given 0.1 mg/kg 2,4-DB during pregency showed stimulated weight gain, altered hepatic weight coefficients (increased in males, decreased in females), and a decreased liver ascorbic acid level. The threshold for the embryotoxic effect of 2,4-DB was established at 0.1 mg/kg, indicating the herbicide's selective embryotoxic action, since the threshold dose for pregnant females was 34 times higher. In peroral doses of 0.1 and 1 mg/kg, 2,4-DB did not affect the gonadal function of males or females.

76-2718. Antonova, V. I.; Mishina, N. E.; Vinokurova, T. V.; Khazova, G. P.; Latkina, L. L. (Author address not given). **Eksperimental'nye dannye k normirovaniyu 1,2-dibrompropan v vode vodoemov. [Experimental data for establishing levels of 1,2-dibromopropane in reservoir water.]** *Gig. Sanit.* 41(3): 105-106; 1976. (5 references) (Russian)

Complex hygienic and toxicological studies on 1,2-dibromopropane, performed to substantiate its maximum allowable level in reservoir water, are described. The practical odor threshold in water was found to be 1.84 mg/liter, and the limit of perception was 1.54 mg/liter. It inhibited the growth of saprophytes in concentrations over 0.1 mg/liter. The acute oral LD50 was determined to be 741 mg/kg in rats and 676 mg/kg in mice. Reduction of the alkaline phosphatase and blood cholinesterase activities, increases in the serum glutamate pyruvate transaminase and in the gastric and duodenal succinate dehydrogenase activity, increased inorganic bromide level in the blood, increase in the renal phosphocreatine and ATP + ADP levels, increased residual nitrogen level in the blood, reduction of the hemoglobin level and of the erythrycyte count, increased reticulocyte count, disturbance of the estrous cycle, reduced fertility, and increased postnatal mortality among the offspring were found in 6-month chronic experiments in white albino rats and mice receiving daily doses of 2.5 mg/kg or more p.o. Disturbances in the conditioned reflex activity were observed following the administration of 0.05 mg/kg. The maximum allowable concentration of 1,2-dibromopropane in water is recommended to be set at 0.1 mg/liter, corresponding to a daily intake of 0.005 mg/kg.

76-2719. Avezbakiev, I. I.; Pulatov, B. A. (Uzbek Sci. Res. Inst. of Sanit., Hyg., Occup. Dis., Tashkent, USSR). **Materialy k gigienicheskomu normirovaniyu kil'valya v vode vodoemov.** [**Information for hygienic standarization of kilval in reservoir water.**] *Gig. Sanit.* 41(3): 107-108; 1976. (4 references) (Russian)

Complex studies carried out to provide information for the hygienic standardization of kilval (vamidothion, *O,O*-dimethyl-*S*-2- (1-*N*-methylcarbamoylmercapto)-ethylthiophosphate) in water are presented. Kilval caused changes in the organoleptic properties of water in concentrations over 0.31 mg/liter. It was found to be rather stable in water. In concentrations of 0.03 and 0.3 mg/liter, kilval stimulated the growth of saprophytes and increased the BOD5. The LD50 was found to be 40±5.8 mg/kg in albino mice, 103±8.5 mg/kg in rats, and 117±12.5 mg/kg in cats. Prolonged oral treatment with 2.06-10.3 mg/kg corresponding to total doses of 2.5-12.6 LD50 caused no mortality, but functional changes in different organs were observed. Changes in the hemoglobin level; erythrocyte and leukocyte counts; vitamin C levels in the plasma, adrenals, and liver; increased weight ratio of the liver and adrenals; and inhibition of the cholinesterase activity were observed in animals fed daily doses of 0.515 mg/kg or more for 12 months. A dose of 0.26 mg/kg was found to be ineffective.

76-2720. Vorob'eva, N. M.; Lapchenko, V. S. (Lab. Toxicol., Sci. Res. Inst. Food Hyg., Kiev, USSR). **Funktsional'nye izmeneniya pecheni pri vozdeystvii na organizm fosfororganicheskikh pestitsidov.** [**Assessment of liver function in animals exposed to organophosphate pesticides.**] *Gig. Sanit.* 41(3): 108-110; 1976. (2 references) (Russian)

The effect of anthio (formothion), amiphos (DAEP), and ciodrin (crotoxyphos), was studied on the liver function of dogs. The animals received daily oral doses of 16.3 mg/kg anthio, 2.02 mg/kg ciodrin, and 25 mg/kg amiphos (1/20 of LD50) over one month. The total protein content of the liver was 5.8-6.12 g% compared to 5.8% in the controls. A pathological glycemic curve was found for ciodrin-treated dogs after galactose loading. The albumin levels were 39.1-47.7% against 54.8% in the controls, while the globulin levels reached 52.61.2% against a control value of 44.9%. The hepatic glutamate-aspartate transaminase activity was 6.6-8.7 μmol/mg compared to 8.9 μmol/mg in the controls. The hepatic GDT activity was 11.3-17.8 μmol/mg compared to 9.5 μmol/mg in the controls. The glycogen level ranged from 11.2 to 14.4 g% against 5.54 g% in the controls. The cholinesterase activity of the erythrocytes was 6.9-13.9 μg/ml/min against 27.9 μg/ml/min in the control group. The hepatic cholinesterase activity was 28.5-31/8 μg/ml/min. Compared to a control value of 390.6 μg/g/min. The functional changes of the liver were most pronounced in the group treated with ciodrin. The findings indicate considerable functional changes in the liver as a consequence of exposure to organophosphates.

76-2721. Strateva, A. (Med. Acad. Cen. Hyg., Sofia, Bulgaria). **Eksperimental'noye obosnovaniye predel'no dopustimykh kontsentratsiy propakhlora (ramroda) v vodakh.** [**Experimental substantiation of the maximum permissible concentrations of propachlor (ramrod) in water.**] *Gig. Sanit.* 41(4): 85-87; 1976. (4 references) (Russian)

Threshold concentrations of ramrod (propachlor) on the basis of the organoleptic index (intensity of 1 point) were: 7.35 mg/l for 9.68 mg/l for color, and 15.96 mg/l for odor. Subthreshold concentrations with regard to suppression of biochemical oxygen (20 mg/l), bactericidal effect on *Escherichia coli* (0.075 mg/l), and toxicity for fish (1 mg/l) were also determined. Ramrod had a toxic effect on mammals and may be classified in the group of moderately toxic compounds: LD50 was 950 (860-1050) mg/kg for rats, 392 (272-565) mg/kg for rabbits, and 290 (240-350) mg/kg for mice. Experiments with rats showed that ramrod had a weak cumulative effect, and that an initial reaction was followed by a period of adaptation and apparent equilibrium, which was in turn succeeded by decompensation. A characteristic clinical syndrome (weight loss and changes in peripheral blood, redox processes, and protein metabolism) and a characteristic pathomorphological picture (dystrophic changes in the liver and kidneys) were observed in the rats. The threshold dose for these animals was 5 mg/kg, and the subthreshold dose was 0.5 mg/kg. The daily permissible dose for humans was calculated (with a reliability factor of 10) at 0.05 mg/kg. The maximum permissible concentration was calculated at 1 mg/l for drinking water 1 mg/l for waters supporting fish, and 20 mg/l for water used in irrigation.

76-2722. Molchan, A. P.; Padenov, K. P.; Andreyev, A. S. (Belorussian Sci.-Res. Inst. Plant Protection, USSR). **Vliyaniye gerbitsidov na mikrofloru pochvy.** [**The effect of herbicides on the soil microflora.**] *Khim. Sel'sk. Khoz.* 14(4): 47-48; 1976. (8 references) (Russian)

In field experiments on fiber flax plantings, arezine (monolinuron), linuron, and propazine at 1 kg/ha inhibited the development of all groups of soil microorganisms studied over the course of 60 days following application. The effect on ammonifiers and nitrifiers was particularly strong, while the mold fungi, actinomycetes, and nitrogen mineralizer were somewhat less affected. After 75 days the toxic effect of the herbicides on the microflora was weakened, and after 100 days the development of all the groups of microorganisms was stimulated, with their numbers exceeding the control level by 1 1/2-2 times. The increase in actinomycetes was especially strong following propazine application. In laboratory experiments, microfloral activity remained weak even 75 days after the herbicides were applied in the same dose as in the field experiments. As in the field experiments, ammonifiers and nitrifiers were most inhibited, while cellulose decomposers, actinomycetes, mold fungi, and users of mineral forms of N were less affected.

76-2723. Anina, I. A. (Inst. Ind. Hyg. Occup. Dis., Kiev, USSR). **O vozmozhnosti ispol'zovaniya pokazateley obmena nukleinovykh kislot dlya prognozirovaniya otdalennykh posledeystviy vliyaniya nekotorykh pestitsidov. [Possibility of using nucleic acid metabolic indixes for predicting long-term consequences of the effect of some pesticides.]** *Gig. Tr. Prof. Zabol.* 3: 51-53; 1975. (14 references) (Russian)

The effects of thiocarbamate pesticides (molinate, EPTC, pebulate), phosmet, and DDT on the gonadal nucleic acid metabolism was examined in male rats in a study on the possible use of the metabolic changes as a prognostic factor for predicting the long-term consequences of the effects of these pesticides. The preparations were administered orally in a dose of 1/100 of LD50 during the last two months preceding sexual maturity. Molinate, phthalphos, and DDT caused a decrease in the nucleic acid level in the gonads, while tillam and eptam caused no significant changes. The disturbance in the nucleic acid metabolism in the gonads of rats treated with molinate, phthalophos, and DDT was due to their intensified decomposition and to inhibition of the nucleic acid synthesis. Similar changes were observed when the phthalophos dose was reduced to 1/300 LD50. Yalan, phthalophos, and DDT had been found to interfere with the reproductive function in earlier experiments, but tillam and eptam had no such effect. In view of this evidence, the recent findings indicate that the disturbances in the gonadal nucleic acid metabolism can be used for predicting long-term consequences of pesticides.

76-2724. Spynu, E. I.; Sova, R. E.; Zor'yeva, T. D.; Tovmachenko, N. N. (Inst. Hyg. Toxicol. Pestic. Polymers Plastics, Kiev, USSR). **Primeneniye simpleksnogo planirovaniya eksperimenta dlya izucheniya kompleksnogo deystviya tsidiala. [Use of simplex planning of an experiment for studying the complex action of cidial.]** *Gig. Tr. Prof. Zabol.* (2): 52-54; 1976. (4 references) (Russian)

The action of the organophosphorus pesticide, cidial (phorate), was studied during its simultaneous entry into the body with food products or water and through the skin. The main advantage of the mathematical model using the simplex method is the small number of experiments needed to verify model data (e.g. 7 instead of 27). Cidial administered to rats inhibited cholinesterase activity to the same extent when given per os in an aqueous emulsion or in an oil solution, but cidial absorption through the skin inhibited cholinesterase activity to a greater extent. Cidial simultaneously administered by all 3 routes inhibited cholinesterase activity by 46% when the cumulative inhibition of cholinesterase activity should theoretically have been 67%.

76-2725. Gurova, A. I.; Alekseeva, N. P.; Gorlova, O. E.; Chernyshova, R. A. (Patrice Lumumba University, Moscow, USSR). **Materialy k obosnovaniyu PDK v vozdukhe rabochey zony *m*-triftormetilfenilizotsianata i butilizotsianata. [Data for establishing MAC for *m*-trifluoromethylphenylisocyanate and butylisocyanate.]** *Gig. Tr. Prof. Zabol.* 3: 53-55; 1976. (5 references) (Russian)

The acute and chronic toxicity of *m*-trifluoromethylphenylisocyanate (TMI) and butylisocyanate (BI) was studied in mice, guinea pigs, rats, and rabbits. TMI has a slight irritative effect on the skin and eye mucosa, while BI caused pronounced hyperemia, dryness, and edema on the skin, and hypermia, lacrymation, and blepharospasm in the eyes. Both substances were found to have weak cumulative properties. The acute oral LD50 was determined to be 975 mg/kg for TMI and 150 mg/kg for BI in mice, 975 mg/kg for TMI and 600 mg/kg for BI in rats, and 478 mg/kg for TMI and 250 mg/kg for BI in guinea pigs. The LC50 in air is 3.3 mg/liter for TMI and 0.68 mg/liter for mice, and 3.6 mg/liter for TMI and 3.0 mg/liter for TMI and 0.68 mg/liter for mice, and 3.6 mg/liter for TMI and 3.0 mg/liter for BI in rats. The chronic threshold level of TMI is 6.1 mg/m^3 in both mice and rats. A concentration of 1.3 mg/m^3 was ineffective with respect to functional tests and histological criteria. The maximal allowable concentration of TMI and BI at workplaces is recommended to be set at 1.0 mg/m^3.

76-2726. Balon, Ya. G.; Oleynik, B. V.; Reznikov, A. G. (Sci. Res. Inst. Endocrinol. Metab. Kiev, USSR). **Izuchenye adrenokortikoliticheskoy aktivnosti proizvodnykh 1,1-Difeniletana. [Study of adrenocorticolytic activity of some 1,1-diphenylethane derivatives.]** *Fiziol. Aktiv. Veshchestva* 7: 37-39; 1975. (3 references) (Russian)

The adrenocorticolytic effect of 1,1-diphenylethane derivatives and the morphological changes they produce in the adrenal cortex were studied in adult male dogs which received 25-100 mg/kg doses of these substances in their diet for 7-34 days. The adrenocorticolytic activity and the functional status of the adrenal cortex were evaluated via the plasma hydrocortisone level determined fluorometrically, at rest and 2 hours after i.v. administration of 20 units of ACTH. The substances studies can be arranged in the following order of adrenocorticolytic activity: *o,p'*-DDD, perthane, *p,p'*-DDD (TDE), *m,p'*-DDD, and 1,1-bis-(*p*-methylphenyl)- 2,2-dichloroethane. The first four substances damaged the cells of the fascicular and reticular zones, and caused focal hemorrhage, degeneration, and focal dystrophy of the adrenal cortex. Response to ACTH stimulation was either absent or very weak. Only the parenchymatous cells of the fascicular zone were damaged by 1,1-bis-(*p*-methylphenyl)- 2,2-dichloroethane. The therapeutic effectiveness of *o,p*-DDT in Cushing's syndrome and tumors of the adrenal cortex is being studied in clinical trials.

76-2727. Lipsett, M. B. (Case Western Reserve Univ., Cleveland, Ohio). **Adrenal carcinoma.** *IN: Hormones and Cancer.* K. K. N. Charyulu and A. Sudarsanam, Eds., New York, Stratton Intercontinental Medical Book Corp., 1976, p. 197-203. (28 references)

The treatment of adrenal cancer is not encouraging. There is, however, ample evidence that chemotherapy may lower the body tumor burden. Treatment with *o,p'*-DDD is more effective in patients whose tumor has been partially resected than in those who have not undergone surgery. Thus, resection of the tumor mass is suggested even when surgery is clearly not curative. The mechanism of action of *o,p'*-DDD is unknown. The drug damages the adrenal cell in the dog and possibly in man, thus causing potential adrenal cell death. There is little evidence that *o,p'*-DDD selectively inhibits particular enzymes in the biosynthetic pathway, although 11-hydroxylation has been reported to be sensitive to the drug. Although *o,p'*-DDD persists in the blood and tissues for prolonged periods, manifestations of toxicity such as nausea and vomiting may disappear within a few days of cessation of therapy. Other side effects may include diarrhea, skin rashes, and fever. Apathy and drowsiness are common. Nystagmus is noted occasionally. It is suggested that one begin with 8-10 mg/day and continue at this dose until toxicity, usually anorexia, is reached. Then reduce the dose by one third to one half and continue until there is evidence of either regression or progression of the disease. Patients may be given 5-7.5 mg prednisone/day to fight possible glucocorticoid insufficiency during treatment. Whether *o,p'*-DDD should be used immediately after surgery is an important, but unsettled, question.

76-2728. Verma, S. R.; Gupta, S. P. (Pollut. Relevant Res. Unit, Dep. Zool., D.A.V. Coll. Nuzaffarnagar, India). **Pesticides in relation to water pollution (accumulation of aldrin and ethyl parathion in the few tissues of *Colisa fasciatus* and *Notopterus notopterus*).** *Indian J. Environ. Health* 18(1): 10-14; 1976. (11 references)

Colisa fasciatus and *Notopterus notopterus* were treated with aldrin (0.00155-0.01 mg/l water) and ethyl parathion (1.00-1.35 mg/l) for periods of 4 hr, 5 days, and 15 days. The accumulation of pesticide in various tissues was determined using phenyl azide photometry and colorimetry. Both compounds accumulated to the greatest extent in the liver and to the least extent in the intestine; accumulation in the muscles and kidney was intermediate. Accumulation in all organs was greatest after 4 hr exposure and least after 15 days exposure. *C. fasciatus* accumulated more pesticide than *N. notopterus*, and aldrin was accumulated to a greater extent than parathion in both species. Maximum accumulation was observed sooner after exposure to high doses than to low doses. *C. fasciatus* and *N. notopterus* appear to accumulation aldrin and ethyl parathion in the same manner.

76-2729. Bhattacharya, S.; Mukherjee, S.; Bhattacharya, S. (Dep. Zool., Visva-Bharati Univ., Santiniketan, India). **Toxic effects of endrin on hepatopancreas of the Teleost fish, *Clarias batrachus* (Linn.).** *Indian J. Exp. Biol.* 13(2): 185-186; 1975. (14 references)

Attempts were made to correlate the concentration of endrin with histopathological changes and altered α-amylase activity in the hepatopancreas and to determine the 48 hr LC50 of the compound to *Clarias batrachus* (Linn.). Fish were exposed to concentrations of 0.001, 0.003, 0.005, 0.008, 0.0095, and 0.011 ppm endrin. Immediately after exposure to the test solutions the fish became hypersensitive and showed a rapid rate of opercular movement, accompanied by occasional gulping of air. The higher the concentrations, the more pronounced were these effects. After several minutes the fish lost equilibrium, remained vertically suspended with complete cessation of movements, and finally died. The 48 hr LD50 of endrin was 0.005 ppm. Histopathological changes were characterized by swollen liver cells, liver cord disarray, and surface irregularities. Binucleated hepatic cells and cells with a greatly enlarged nucleus were seen occasionally. The severity of these effects was dose dependent. Hepatopancreatic amylase activity at 0.005 ppm was inhibited by 66%. In those fish removed from the 0.005 ppm exposure solution and placed in fresh water the amylase activity returned to normal after about 72 hr. It is suggested that this return of the α-amylase activity in endrin-exposed fishes may be due to gradual regeneration of hepatopancreas tissue.

76-2730. Kashyap, S. K.; Gupta, S. K. (Natl. Inst. Occupational Health, Ahmedabad, India). **Effect of ultra low-volume aerial spray of phosphamidon (organophosphorus insecticide) on human volunteers: a field surveillance study.** *Indian J. Med. Res.* 64(4): 579-583; 1976. (3 references)

A toxicological evaluation was made of ultra-low volume (ULV) aerial spraying of phosphamidon under local conditions of use in view of the potential hazards involved in this type of operation. An area of about 150 hectares of paddy crops in the Trichy district of Tamil Nadu was studied. Phosphamidon (1000 g/liter) was used for ULV spray in doses of 550 g/hectare, which is almost twice the recommended dose. The aircraft flew at a height of about 35 feet and speed of 90 miles/hr with a spray swath of 75 meters. Thirty-two subjects, aged 10-70 yr, were used in the study. They were stationed within a 10 hectare sector of the spraying area during application and for 1 hr afterwards. The subjects showed only mild irritation of conjuctivae, i.e., irritation of eyes and lacrimation, which started immediately after insecticidal application. No other clinical abnormalities were observed. ChE determinations showed no statistically significant inhibitory effect on red cell cholinesterase activity. The ChE activity in plasma did show a significant decrease on the third day after exposure, which gradually recovered by the ninth day. In all exposed humans the plasma cholinesterase depression was in the range of 15 to 65%. The time interval when maximum depression was reached ranged from 1 to 3 days. In over 65% of the individuals the depression was more than 25% in plasma ChE activity. The results of this study indicate a clear need for continued monitoring of ULV aerial spray operations, especially when highly toxic

pesticides are involved.

76-2731. Garg, F. C.; Tauro, P.; Grover, R. K. (Dep. Microbiol., Haryana Agric. Univ., Hissar, India). **Effect of fungitoxicants on *Rhizobia*.** *Indian J. Microbiol.* 13(3): 179-181; 1973. (8 references)

The effect of three systemic fungitoxicants, carboxin, oxycarboxin, and triazine (dyrene) on the growth of *Rhizobium meliloti* Dang., were studied. Triazine (500 μg/ml) completely inhibited growth of *R. meliloti*, while carboxin and oxycarboxin inhibited growth by 90%. At this concentration the chemicals also inhibit growth of *Escherichia coli* and *Bacillus* sp., but to a lesser degree. Bengal gram seeds were treated with three different fungitoxicant solutions (500 μ/ml for 30 min), dried, and sown in soil rich in *R. meliloti*. Germination of treated and untreated seeds was identical and normal, suggesting that treatment had no effect on germination. Neither was the degree of nodulation affected.

76-2732. Muzzarelli, R. (Fac. Med. Chir., Univ. Ancona, Ancona, Italy). **Un futuro dramma ecologico? Insetticidi inibitori della sintesi della chitina. [A future ecological tragedy? Insecticidal inhibition of the synthesis of chitin.]** *Inquinamento* 16(3): 29-30; 1974. (6 references) (Italian)

The insecticide 1-(2,6-dichlorobenzoyl)- 3-(3,4-dichlorophenyl)-urea (DU 19111) have been shown to inhibit chitin synthesis in various insects. In some, the insecticide kills at the time of metamorphosis; histological examination of the killed larvae show an altered cuticular matrix, indicating alterations in the process of endocuticular deposition (glycoprotein complex with chitin as the polysaccharide). Labeled chitin in DU 19111-fed insects was scarce compared to that of controls, thereby showing that the insecticide inhibits chitin synthesis. Chitin is produced by numerous organisms other than insects, e.g., fungi, plankton, and mold. The lethal dose of DU 19111 in mice is 3160 mg/kg orally, and over 1000 mg/kg intraperitoneally. Its degradability is unknown.

76-2733. Matsushita, T.; Arimatsu, Y.; Nomura, S. (Dep. Public Health, Kumamoto Univ. Med. Sch., Honjo, Kumamoto, Japan). **Experimental study on contact dermatitis caused by dithiocarbamates maneb, mancozeb, zineb, and their related compounds.** *Int. Arch. Occup. Environ. Health* 37(3): 169-178; 1976. (30 references)

A study was made of the mechanism of contact dermatitis due to maneb, mancozeb, zineb, ethylene thiourea, dimethyl dithiocarbamic acid sodium salt, and lime sulfur mixture. Maneb, mancozeb, zineb, dimethyl dithiocarbamic acid sodium salt, and lime sulfur mixture showed dominant irritating effects on subcutaneous sites of the guinea pigs studied. Ethylene thiourea indicated a slight reaction. These reactions were nearly in proportion to their concentrations. The results of guinea pig maximization tests showed that an allergic mechanism played an important role in the pathogenesis of contact dermatitis caused by these dithiocarbamates.

76-2734. Borzsonyi, M.; Pinter, A.; Surjan, A.; Farkas, H. (Natl. Inst. Hygiene, 1966 Budapest, Hungary). **Transplacental induction of lymphomas in Swiss mice by carbendazim and sodium nitrite.** *Int. J. Cancer* 17(6): 742-747; 1976. (36 references)

The carcinogenic effect of carbendazim and sodium nitrite in the offspring of mice treated with these substances simultaneously is reported. Pregnant Swiss mice were used for the study. Lymphomas developed in 33.3% of the young mice whose mothers were treated in the first week of pregnancy, in 53.3% of those whose mothers were treated during the second week, and in 38.8% of those born of mothers treated during the third week. Treatment during the whole period of pregnancy yielded on an average 70.0% malignancy in offspring. Administration of carbendazim alone did not produce lymphomas in the first generation. In lymphomas induced by in vivo-generated *N*-nitroso compounds, A- and C-type oncornavirus particles were noted with the electron microscope.

76-2735. Skryabin, G. K.; Golovleva, L. A. (Inst. Biochem. Physiol. Microorg., Acad. Sci. USSR, Pushchino, USSR). **Mikrobiologicheskaya transformatsiya i degradatsiya pestitsidov. [Microbiological transformation and degradation of pesticides.]** *Izv. Akad. Nauk SSSR Ser. Biol.* 6: 805-819; 1975. (58 references) (Russian)

Literature on the bacterial and fungal transformation and degradation of insecticides, herbicides, and fungicides is reviewed. Enzymatic degradation can detoxify the pesticide or the pesticide can be transformed into toxic substances, into a compound with a different inhibiting effect, or into a stimulator compound. Pesticides reviewed are phenoxyalkanoic acids (2,4-D, 2,4,5-T); higher phenoxyalkylcarboxylic acids (2,4-dichlorophenoxyalkyl carboxylic acid); organochlorine pesticides (pentachlorophenol, polychloro-substituted biphenyls, DDT); carbamates (chloropropham); urea derivatives; and triazines. The most extensive transformation occurred with mixed cultures.

76-2736. Ohkawa, H.; Okihara, Y.; Miyamoto, J. (Res. Dep., Pestic. Div., Sumitomo Chem. Co., Takarazuka, Hyogo, Japan). **Metabolism of the fungicide Denmert (*S-n*-butyl *S'-p-tert*-butyl-benzyl *N*-3-pyridyldithiocarbonimidate, S-1358) and Denmert sulfoxides in liver enzyme systems.** *Agric. Biol. Chem. (Tokyo)* 40(6): 1175-1182; 1976. (12 references)

On incubation with rat liver microsomes plus NADPH, Denmert (S-*n*-butyl S'-*p*-*tert*-butylbenzyl N-3-pyridyldithiocarbonimidate) underwent at least two different types of oxidation; hydroxylation and sulfoxidation. Hydroxylation of Denmert at the *tert*-butyl group was one

of the major metabolic attacks in mammalian metabolism. Sulfoxidation of Denmert gave two isomers of Denmert sulfoxides which were intermediates in the metabolism and readily transformed into 2-(3′-pyridylimino)-4-carboxythioazolidine (HM) in the presence of L-cysteine without enzymatic mediation. This type of conjugation with cysteine appears to be a new class of metabolic reactions in mammals. Denmert S-oxide showed increased fungicidal activity when assayed in liquid cultures, but not on plant leaves. (Author abstract by permission)

76-2737. Galal, E. E.; Latif, M. A.; Kandil, A.; Kamel, S. (Drug Res. Contr. Cent., Giza, Egypt). **The percutaneous cardiac toxicokinesis of anticholinesterase insecticides.** *J. Drug. Res. Egypt* 7(2): 29-43; 1975. (17 references)

Cardiotoxic effects due to insecticides with anticholinesterase activity were studied using methyl parathion, malathion, and carbaryl as examples. Both oral and percutaneous routes of exposure were considered. Each insecticide was tested at the oral LD50 doses, half this dose, the percutaneous LD50 dose, and half the percutaneous LD50 dose. The data from this study indicates that the most potent of these insecticides is methyl parathion, by both methods of exposure. It precipitated severe bradycardia and arrhythmia, with overt signs of cardiac ischemia and dissociation of the ventricular complex. Malathion presented almost the same cardiotoxic effects. Its toxic actions were slightly less intense than those of methyl parathion. It possessed considerable cardiac toxicity through dermal contamination. Carbaryl was less toxic orally and dermally and thus the bradycardic effect of the carbamate compound on the cholinesterase enzyme. It is concluded that the cutis presents a feeble barrier against the toxicokinetics of organic phosphorus compounds. Both the cutaneous diffusibility and lack of rapid detoxification explain the similarities in toxicodynamic effect through the oral and cutaneous routes.

76-2738. Bakke, J. E.; Feil, V. J.; Price, C. E. (Metabolism Radiation Res. Lab., ARS, USDA, Fargo, ND 58102). **Rat urinary metabolites from *O,O*-diethyl-*O*-(3,5,6-trichloro-2-pyridyl) phosphorothioate.** *J. Environ. Sci. Health* B11(3): 225-230; 1976. (5 references)

The rat urinary metabolism of *O,O*-diethyl-*O*-(3,5,6-trichloro- 2-pyridyl-2,6-^{14}C) phosphorothioate was examined. Chlorpyrifos (labeled as shown above) was fed to rats in one oral dose of 5 mg (2.97 μCi per rat) of chloropyrifos. Three of six metabolites accounted for 96% of the urinary radioactivity. They were identified as the glucuronide of 3,5,6-trichloro-2-pyridinol (80% of the urinary radioactivity), a glycoside of 3,5,6-trichloro-2-pyridinol (4%), and 3,5,6-trichloro-2- pyridinol (12%).

76-2739. Klaverkamp, J. F.; Lockhart, W. L.; Metner, D.; Grift, N. (Dep. Environ., Fish. Mar. Serv., Freshwater Inst., Winnipeg, Manitoba, Canada). **Effects of chronic DDT/DDE exposure on anesthetic induction and recovery times in rainbow trout (*Salmo gairdneri*).** *J. Fish. Res. Board Can.* 33(6): 1331-1334; 1976. (29 references)

In rainbow trout (*Salmo gairdneri*) fed pellets containing 4.55 μg/g of *p,p′*-DDT and 6.81 μg/g of *p,p′*-DDE every other day, anesthetic induction and recovery times of phenoxyethanol (PE) were less than those in trout fed control pellets. No interactions were observed in fish fed DDT/DDE and anesthetized with ethyl *m*-aminobenzoate methanesulphonate (M.S. 222). Differences observed between fish fed DDT/DDE and anesthetized with PE as compared to M.S. 222 could be due either to enhanced metabolism of PE or to the fact that PE and M.S. 222 have different modes or sites of action. (Author abstract by permission)

76-2740. Rowlands, D. G. (Insects. Storage Dep., Min. Agric. Fish. Food, Pest Infest. Control Lab., Slough, Berks., England). **The uptake and metabolism by stored wheat grains of an insect juvenile hormone and two insect hormone mimics.** *J. Stored Prod. Res.* 12(1): 35-41; 1976. (12 references)

The possible use of three juvenile hormone mimics was studied in stored grain. The compounds tested were JH-1, Bowers' 2b (a methylene-dioxyphenyl compound) and the compound methoprene which is currently in limited commercial production. All three compounds penetrated the grain rapidly irrespective of the method of exposure or application, i.e., vapor or topical, or the vehicle applied (undiluted compound, aqueous emulsion, or solution). Although the amounts sorbed differed between the vapor and topical treatment, the results were similar. The only quantitative difference noted was that the proportion absorbed by the germ region from the vapor phase was initially higher than from solutions, but this effect was transient. After two days the internal distribution was similar in all cases, highest residues occurring in the aleurone layers, much less in the germs, and hardly any in the endosperms or outer seedcoats. Residual half-lives at 20°C in freshly-harvested wheat of 19% moisture were: JH-1, 1-2 weeks; Bowers' 2b, 5-6 weeks, and Altosid, 2-3 weeks. Metabolic changes noted included opening and hydroxylation of epoxide groups and ester cleavage.

76-2741. Muramatsu, M.; Kuriyama, K. (Dep. Pharmacol., Kyoto Pref. Univ. Med., Kamikyo-ku, Kyoto 602, Japan). **Effect of organophosphorus compounds on acetylcholine synthesis in brain.** *Jpn. J. Pharmacol.* 26(2): 249-254; 1976. (15 references)

The effects of parathion and diisopropyl fluorophosphate (DFP) on cholinesterase (ChE) activity were studied along with the effects of these compounds on the activity of choline acetyltransferase (ChAc) and on the uptake of choline in subcellular fractions from the mouse brain. Male ddy mice were used in the study. The results of the study showed that not only is parathion a ChE inhibitor, but it also inhibits the activity of ChAc and the

uptake of choline into brain subcellular fractions. The inhibitory effects of parathion on ACh synthesis in brain tissue were greater than the inhibitory effects on ChAc activity or on choline uptake, suggesting that the inhibition of ACh synthesis by parathion may be a reflection of the inhibitory effects of this compound on both parameters. Parathion exhibited these inhibitory effects on both ChAc activity and choline uptake simultaneously. DFP inhibited ChE activity, but had no significant effects on choline uptake and ACh synthesis per se. A brief discussion of the possible significance of these findings in the pharmacological actions of organophosphorus compounds is given.

76-2742. Schimmel, S. C.; Patrick, J. M., Jr.; Forester, J. (U.S. EPA, Environ. Res. Lab., Sabine Island, Gulf Breeze, FL 32561). **Heptachlor: toxicity to and uptake by several estuarine organisms.** *J. Toxicol. Environ. Health* 1(6): 955-965; 1976. (18 references)

The 96 hr EC50 of technical-grade heptachlor to the American oyster; the 96 hr LC50 of heptachlor to pink shrimp, grass shrimp, sheepshead minnow, pinfish, and spot; the 96 hr LC50 of heptachlor to pink shrimp and spot; and the 96 hr LC50 of heptachlor epoxide to pink shrimp are reported. Pink shrimp were the most sensitive with an LC50 of 0.11 μg/liter. Pinfish and sheepshead were 3.77 and 3.68 μg/liter, respectively. Grass shrimp had an LC50 of 1.06 μg/liter. When using analytical-grade heptachlor, pink shrimp were also the most sensitive with the LC50 of 0.03 μg/liter, while the spot had an LC50 of 0.86 μg/liter. Heptachlor epoxide was also very toxic to pink shrimp with an LC50 of 0.04 μg/liter. Heptachlor epoxide readily accumulated in the tissues of pink shrimp, with the highest concentration being nearly 3 times that of heptachlor. These studies indicate that significant mortality may occur in pink shrimp populations without the compound being detected in water or in the tissues.

76-2743. Highman, B.; Gaines, T. B.; Schumacher, H. J.; Haley, T. J. (Dep. Pathol., Univ. Arkansas Med. Cent., Little Rock, AR 72079). **Strain differences in histopathologic, hematologic, and blood chemistry changes induced in mice by a technical and a purified preparation of 2,4,5-trichlorophenoxyacetic acid.** *J. Toxicol. Environ. Health* 1(6): 1041-1054; 1976. (7 references)

The possible influence of strain and sex on toxicity of 2,4,5-T and possible relations between maternal lesions and increased incidence of fetal abnormalities noted in mice given 2,4,5-T were studied in 978 mice. On gestation days 6 through 14, groups of pregnant and nonpregnant CD-1 mice and male and nonpregnant female dihybrid cross F_2 mice received 2,4,5-T (30 to 140 mg/kg). Mice were killed when they became moribund and at 1, 2, 4, 6, 8, and 11 days after treatment. Severe myocardial lesions, hypocellularity of bone marrow, and depletion of lymphocytes in thymus, spleen, or lymph nodes were noted in sick or moribund mice after 2 to 9 doses of 2,4,5-T. Marked hemotologic and blood chemistry changes were also observed. The incidence of animals becoming moribund was less than 1% in CD-1 mice, including those receiving 140 mg/kg, and 53-82% in male and female F_2 mice receiving 120 mg/kg. Incidence of moribund mice was higher in male than in female F_2 mice and in those given the purified rather than the technical preparation of 2,4,5-T. Thus, maternal health is impaired by severe lesions early in gestation, but this is not the primary cause of an increase in incidence of fetal abnormalities observed in mice given 2,4,5-T. The lesions were due primarily to 2,4,5-T rather than to impurities in the technical preparation. The importance of using more than one strain of mouse in a toxicologic or teratologic study is demonstrated.

76-2744. Tsonevski, D. (Hyg. Epidemiol. Inspectorate, Ruse, Bulgaria). **Kombinirano deistvie na fosfororganichni, khlororganichni i ditiokarbamatni preparati. [Toxicity and character of combined action of organophosphate, organochlorine, and dithiocarbamate preparations.]** *Khig. Zdraveopazvane* 17(6): 536-541; 1974. (19 references) (Bulgarian)

Mean lethal doses for mixtures of rogor (dimethoate) and lindane (1:2) and rogor, lindane, and zineb (1:1:1) were determined after a single injection in experimental animals. Both the two and three component mixtures were found to be of moderate toxicity for warm blooded animals. When injected into white mice the mixtures yielded antagonism factors of 0.525 and 1.9 for the 2 and 3 component mixtures, respectively, calculated by the method of Kagan. When injected in the white rat, the combined action of rogor and lindane was manifested as an additive effect, whereas the activity of rogor with lindane and zineb was manifested as an antagonism.

76-2745. Avezdzhanova, G. P.; Tkachenko, M. P.; Yunusov, M. R. (Author address not given). **Vliyaniye benomila na mikrofloru pochvy i urozhaynost' khlopchatnika. [The effect of benomyl on the soil microflora and cotton productivity.]** *Khim. Sel'sk. Khoz.* 14(4): 35-36; 1976. (10 references) (Russian)

The effect of benomyl application during fall plowing in doses of 0-200 kg/ha on soil microflora and cotton yield was tested in an area of long-irrigated serozem with a deep groundwater level and an unsalinized loamy mechanical composition. Soil fungi, actinomycetes, bacteria, ammonifiers, denitrifiers, butyric acid fermenters, nitrifiers, clostridia, cellulose-decomposers, and azotobacter species were studied. The total quantity of the microflora increased as a result of benomyl application. The numbers of bacteria and actinomycetes were particularly increased, while the fungal population increased insignificantly only after a benomyl dose of 200 kg/ha. In general, soil microfloral activity was stimulated following application of the higher doses of the pesticide. Benomyl intensified the soil fungicidal potential and inhibited the growth of *Verticillium dahliae* microsclerotia, evidently as the result of both

a direct toxic effect and the activation of soil microflora, including *V. dahliae* antagonists. Cotton yield was increased.

76-2746. Borona, V. P.; Karbovskaya, A. V. (Author address not given). **Vliyaniye smesey gerbitsidov na mikrofloru pochvy i urozhai sakharnoi svekly. [The effect of herbicide mixtures on the soil microflora and sugar beet yield.]** *Khim. Sel'sk. Khoz.* 14(4): 37-39; 1976. (8 references) (Russian)

The effects of lenacil alone or in combination with TCA, dichloralurea, or tillam (pebulate), and of ronit (molinate) alone or in combination with eptam (EPTC), tillam, pyramin (pyrazon), or lenacil were tested on soil microorganisms in the 0-20 cm soil layer. The test plot was located in an area of deep low-humus chernozem planted with sugar beets in a moderately humid zone of the right-bank [of the Dnieper] forest-steppe region of the Ukrainian SSR. Mixtures with lenacil and lenacil alone (1.5 kg/ha) manifested their strongest effect on soil microorganisms soon after spray application, causing a significant reduction after 15 days in the numbers of *Clostridium pasteurianum*, oligonitrophils (On), ammonifiers (Am), denitrifiers (Dn), and bacteria decomposing organic P compounds (Pd). Mixtures of TCA and lenacil had an especially strong inhibiting effect on the development of Am and Dn, whose numbers decreased by 72-81% in comparison with the control. Lenacil in mixtures did not affect aerobic cellulose-decomposing bacteria (Cd), but lenacil alone reduced their number by more than one-half. Sixty days after application, the toxic effect of the lenacil mixtures was significantly weakened, as evidenced by increases in the numbers of *C. pasteurianum*, Dn, and Cd, although the numbers of On and Am were still reduced. Lenacil alone continued to depress the development of *C. pasteurianum* and Am even after 60 days. The effect of mixtures with ronit was a function of soil moisture level. When high precipitation levels (129% of the norm) followed application in 1972 and 1973, *C. pasteurianum* numbers were reduced by 70-97% after 25 days, the nitrification capacity of the soil decreased, and the number of On decreased slightly. The development of Cd was depressed only by mixtures of ronit and eptam or lenacil, and the development of Am and Pd was stimulated. Under dry conditions in 1973, the numbers of Am, Pd, and On, and the soil nitrification capacity decreased somewhat 25 days after the application of all of the ronit mixtures with the exception of the ronit-pyramin combination. After 70-90 days, the inhibiting effect of the ronit mixtures was weakened in both 1972 and 1973, with the numbers of some groups of microorganisms attaining or surpassing the control level. In 1973 the numbers of On and Am increased 2-4 times in comparison with the control. In 1972 the mixture of ronit and lenacil depressed *C. pasteurianum* development even 70 days after application. The mixtures containing lenacil were found to have the strongest inhibiting effect on soil microorganisms.

76-2747. Volkov, A. I. (Author address not given). **Pestitsidy i okruzhayuschaya sreda: efiry karbaminovykh kislot (analiticheskii obzor). [Pesticides and the environment: carbamic acid esters (an analytical review).]** *Khim. Sel'sk. Khoz.* 14(4): 60-71; 1976. (60 references) (Russian)

Numerous studies are reviewed concerning various aspects of carbamate pesticides: time period and pathways of their degradation in the soil (microbiological, chemical, and physical processes) and water (in natural waters, primarily biological processes); their metabolism in plants (oxidation and conjugation with endogenous plant components) and animals (oxidation, conjugation, and particularly hydrolysis); the toxicity and toxic effects of their metabolites for mammals (acetylcholinesterase inhibition); the occurrence of carbamate residues in food products and in the environment; and side effects of the use of carbamates (toxic effect on earthworms). Present knowledge indicates that carbamic acid esters are a relatively harmless class of pesticides which are quickly metabolized and excreted by mammals.

76-2748. Minerik, E.; Ragala, P. (Nat. Inst. Oenol. Viticult., Bratislava, Czechoslovakia). **Vplyv herbicidov na kvasinkovu floru kvasiacich mustov. [Effect of herbicides on the yeast flora of fermenting musts.]** *Kvasny Prum.* 22(4): 88-91; 1976. (5 references) (Czech)

The long-term side effects of herbicides applied to control weeds in vineyards were measured on the yeast flora of grapes and of spontaneously fermenting must. The majority of herbicides had little or no inhibitory effect on the development of the yeast flora. This was true whether the herbicides were used only occasionally or systematically. Urea-based, triazine, and mixed triazine herbicides behaved neutrally. Of the chlorothiamide herbicides tested, only Prefix (chlorthiamide) showed inhibiting effects on the sporeforming yeast species, and this occurred only when the herbicide was not buried in the soil. A slight suppressing effect on spore-forming yeasts was noted for herbicides such as dichlobenil.

76-2749. Sharma, R. P. (Dep. Vet. Sci., Utah State Univ., Logan, UT 84322). **Influence of dieldrin on serotonin turnover and 5-hydroxyindole acetic acid efflux in mouse brain.** *Life Sci.* 19(4): 537-541; 1976. (17 references)

Chronic administration of dieldrin failed to produce any alteration of brain serotonin, norepinephrine or dopamine in mice, but caused an increase in 5-hydroxyindole acetic acid levels. The turnover rate of serotonin was unaffected by dieldrin. The probenecid induced accumulation rate of 5-hydroxyindole acetic acid was considerably lowered in dieldrin-treated mice. The results suggested a possible influence of dieldrin on 5-hydroxyindole acetic acid efflux from mouse brain. (Author abstract by permission)

76-2750. Juengst, F. W., Jr.; Alexander, M. (Lab. Soil

Microbiol., Dep. Agronomy, Cornell Univ., Ithaca, NY). **Effect of environmental conditions on the degradation of DDT in model marine ecosystems.** *Mar. Biol.* 33(1): 1-6; 1975. (13 references)

Various environmental variables were examined to determine which might influence microbial modification of DDT. These variables included salinity, temperature, oxygen tension, presence of sediment, and availability of various organic nutrients. Three model ecosystems were established: one contained 75 ml seawater, another 75 ml of seawater plus 3 to 5 g sediment, and one contained 75 ml sediment placed in 125 ml bottles and covered with seawater to maintain a free water phase of about 5 mm. At temperatures of 4 to 32°C, at various salinities and in the presence or absence of oxygen, no products of DDT metabolism were detected in surface seawater. DDD was formed from DDT in surface waters supplemented with *Cylindrospermum* sp. cells, and both DDD and DDE were produced in surface water-sediment model ecosystems receiving organic amendments. Flooded sediments were very active in converting DDT to DDD, and an unknown compound accumulated in these sediments. In these models no compounds known to be generated microbiologically from DDT in vitro were observed.

76-2751. Markiewicz, Z.; Kurski, B.; Smigielska, J. (Inst. Noninfect. Dis., Dep. Vet. Med., Acad. Agric. Technol., Olsztyn, Poland). **Zachowanie sie niektorych wskaznikow krzepniecia krwi u krolikow w przebiegu doswiadczalnego zatrucia preparatem "Foschor 20". [The behavior of certain indices of blood coagulation in rabbits in the course of experimental Foschlor 20 intoxication.]** *Med. Weter.* 31(4): 231-233; 1975. (11 references) (Polish)

Coagulation, prothrombin time, number of red blood cells, and the content of calcium in the sera of rabbits were determined after application of Foschlor-20 (trichlorfon). Animals were given Foschlor-20 at rates of 500 and 250 mg/kg and then after 1 hr received i.v. injections of atropine with toxogonin. The studies were performed at 1, 3, and 10 days after application of the chemical. Clinical signs of intoxication were present in the animals at 15 min after application of the chemical. The signs were longer lasting in animals not receiving atropine. Coagulation and prothrombin time were shortened in all animals studied. In some animals these values returned to normal after 10 days. The number of platelets increased significantly and the serum calcium content was normal. The changes in coagulation of blood may accompany toxic lesions in the liver caused by the intoxication.

76-2752. El'kind, L. A.; Nuritdinova, F. N. (Tashkent Med. Inst., Tashkent, USSR). **Morfologicheskie dannye izucheniya glaza krolikov pri khronicheskoy intoksikatsii nekotorymi pestitsidami. [Morphological data from studies on the rabbit eye after chronic intoxication with several pesticides.]** *Med. Zh. Uzb.* 12: 37-40; 1974. (Russian)

The morphological changes caused by pesticides and their mixtures in the eyes of rabbits after 6 months of intratracheal administration were studied. The animals received a 1:1 mixture of rogor (dimethoate) and hexachlorane (BHC) in doses of 1.45-4.8 mg/kg, hexachlorane in a dose of 4.8 mg/kg, or 3.8 mg/kg methylmercaptophos. Edema and loosening of the connective tissue of the conjunctiva and cornea, occasional desquamation of the endothelium of Descemet's membrane, and loosening of the cellular elements of the pigmented epithelium and of the columnar layer were observed in animals treated with rogor, hexachlorane, and their mixtures. Thickening of the corneal epithelium, irregular distribution of basal cells, pronounced perinuclear and pericellular edema, loosening and partial desquamation of the surface cells, loosening and hemogenization of the bundles of the collagen fibers of the stroma, pronounced edema of the choroid, and edema and loosening of the sclera were observed in rabbits treated with methylmercaptophos. The morphological changes were most pronounced in the latter group. Treatment with vitamins B_1, B_6, B_{12}, and C, cocarboxylase, galascorbin, dibasol, and methionine was effective in reducing of the morphological changes in the eyes.

76-2753. Laamanen, I.; Sorsa, M.; Bamford, D.; Gripenberg, U.; Meretoja, T. (Dep. Genet., Univ. Helsinki, Helsinki, Finland). **Mutagenicity and toxicity of amitrole. I. Drosophila tests.** *Mutat. Res.* 40(3): 185-190; 1976. (23 references)

Amitrole was highly toxic to early larval stages of Drosophila (LD50 is 40 ppm in medium). Toxicity of amitrole was also revealed by prolongation of development time even at 10 ppm. However, no mutagenic effects of amitrole were observed either in the sex chromosome non-disjunction test (females reared on medium containing amitrole at 10 ppm) or in the sex-linked recessive lethal test (males reared on medium containing amitrole at 10 ppm). (Author abstract by permission)

76-2754. Meretoja, T.; Gripenberg, U.; Bamford, D.; Laamanen, I.; Sorsa, M. (Dep. Genet., Univ. Helsinki, Helsinki, Finland). **Mutagenicity and toxicity of amitrole. II. Human lymphocyte culture tests.** *Mutat. Res.* 40(3): 191-196; 1976. (4 references)

Effects of amitrole (3-amino-1,2,4-triazole) were investigated on human leucocytes in culture. Amitrole interfered with lymphoblast transformation and inhibited cell growth in concentrations of 0.2% w/v and higher. Selected metaphases were examined for the presence of chromosome and chromatid aberrations. No clastogenic effects were observed. (Author abstract by permission)

76-2755. Bamford, D.; Sorsa, M.; Gripenberg, U.; Laamanen, I.; Meretoja, T. (Dep. Genet., Univ. Helsinki, Helsinki, Finland). **Mutagenicity and toxicity of amitrole. III. Microbial tests.** *Mutat. Res.* 40(3): 197-202; 1976. (15

references)

Amitrole (3-amino-1,2,4-triazole) inhibits bacterial growth in both *Escherichia coli* and *Salmonella typhimurium* at a concentration of 0.5% in minimal medium. Repression of growth already occurs at a concentration of 0.1% of amitrole in this medium. In complete medium the bacteria tolerate concentrations of amitrole as high as 1.7-2.4% before growth ceases. Mutagenicity was tested by differential growth comparisons on *E. coli* strains W 3110 *thy pol* A1, defective in DNA polymerase I, and its revertant *pol* A+. Known mutagens (MMS, NTG, mitomycin C) were used as positive controls. Analogous negative results were not obtained in a revertant test when several *trp* mutant strains of Salmonella were used. (Author abstract by permission)

76-2756. Grant, E. L.; Mitchell, R. H.; West, P. R.; Mazuch, L.; Ashwood-Smith, M. J. (Dep. Biol., Univ. Victoria, Victoria, British Columbia, Canada). **Mutagenicity and putative carcinogenicity tests of several polycyclic aromatic compounds associated with impurities of the insecticide methoxychlor.** *Mutat. Res.* 40(3): 225-228; 1976. (7 references)

Several polycyclic hydrocarbons, 3,6-dimethoxy-9,10-bis (*p*-methoxyphenyl)- phenanthrene, tetrakis(*p*-methoxyphenyl) ethylene and 3,6,11,14-tetramethoxydibenzo(g,p) chrysene, which are associated as impurties in commerical samples of the insecticide methoxychlor, have been tested in the Ames mutagenicity test with strains of *Salmonella typhimurium*, TA 1535, TA 1537, TA 1538, and TA 98. Activation by liver microsomes induced with either phenobarbital or Aroclor was examined. The only active compound was 3,6,11,14-tetramethoxydibenzo(g,p) chrysene, mutagenic (0.39 revertants/nmol) to strain TA 98. (Author abstract by permission)

76-2757. Plewa, M. J.; Gentile, J. M. (Dep. Agron., Coll. Agric., Univ. Illinois, Urbana, IL 61801). **Mutagenicity of atrazine: a maize-microbe bioassay.** *Mutat. Res.* 38(4): 287-292; 1976. (23 references)

A water-soluble extract from maize plants grown in the presence of atrazine contained a mutagenic agent(s) when tested on strains of yeast. Atrazine alone or control plants not treated with atrazine did not express mutagenic properties. The reversion frequency at the *waxy* locus in pollen grains from plants grown in atrazine was higher than in control plants. It is suggested that atrazine may be degraded by the plant into environmental mutagenic agents. (Author abstract by permission)

76-2758. Shanahan, G. J.; Roxburgh, N. A. (Biol. Chem. Res. Inst., N.S.W. Dep. Agric., Rydalmere, New South Wales, Australia). **The sequential development of insecticide resistance problems in *Lucilia cuprina* Wied. in Australia.** *PANS* 20(2): 190-202; 1974. (63 references)

Organochlorine, organophosphate, and carbamate insecticides were used extensively in Australia to control *Lucilia cuprina* Wied. Insecticides are particularly valuable against body strike on Merino sheep, especially among the young sheep, in years with intermittent rain during the warmer months. Over the ten year period from 1957 to 1967, resistance to larvicides developed in the blowfly. A comparison is made between the emergence of resistance problems to the newer synthetic insecticides in the housefly in Denmark and in the blowfly in Austrialia. About seven years after their introduction, DDT and gamma-BHC were replaced by cyclodiene insecticides in 1954/1955. Resistance to dieldrin and aldrin developed in late 1957. Diazinon was then introduced. Non-specific resistance to organophosphate insecticides developed in two steps. Low order resistance, diagnosed in 1965, was supplemented by an additional resistance mechanism in 1966, three alleles on two chromosomes are involved. Butacarb was effective against organophosphate resistant strains of the blowfly when introduced in the 1966/67 season. In 1967, resistance to butacarb was diagnosed and rapidly became widespread. It has been noted that resistance factors to both classes of insecticide are significantly higher in larvae than in adult females. Resistance to organophosphate insecticides has stabilized. Resistance levels to butacarb have doubled. It is concluded that registered organophosphate insecticides, but not butacarb, will still give considerable protection against fly-strike as long as the maximum levels of organophosphate resistance reached in lab selection programs are not exceeded in the field. Measures to minimize the amount of insecticide used against the blowfly are advocated and include: improved mules operation, mid season crutching, and good animal husbandry.

76-2759. Nishioka, T.; Kitamura, K.; Fujita, T.; Nakajima, M. (Dep. Agric. Chem., Kyoto Univ., Kyoto, Japan). **Kinetic constants for the inhibition of acetylcholinesterase by phenyl carbamates.** *Pestic. Biochem. Pnysiol.* 6(4): 320-337; 1976. (19 references)

Determinations were made of kinetic constants for various substituted phenyl carbamates with bovine erythrocyte AChE. A procedure was developed in the presence of a chromogenic substrate, based on the suggestion of Hart and O'Brien, and was compared with the conventional Main method. It was found that the "apparent" Kd and k_2 values are in fact dependent on the inhibitor concentration range used for the determination, but that the values are virtually reproducible, even when using different methods with different substrates, when the inhibitor concentration range is not markedly changed. The most "reliable" constants are obtained with a range of rather low inhibitor concentrations insofar as it satisfies the experimental conditions required for inhibition kinetics.

76-2760. Niblett, P. D.; Ballantyne, J. S. (Dep. Zool., Univ. Guelph, Guelph, Ontario, Canada). **Uncoupling of**

oxidative phosphorylation in rat liver mitochondria by the lamprey larvicide TFM (3-trifluoromethyl- 4-nitrophenol). *Pestic. Biochem. Physiol.* 6(4): 363-366; 1976. (21 references)

A study was undertaken to determine whether or not 3-trifluoromethyl- 4-nitrophenol (TFM) is an uncoupler of oxidative phosphorylation, and if so, how its potency relates to that 2,4-dinitrophenol. The uncoupling concentrations causing a 50% reduction in the ADP/O ratios for rat liver mitochondria were 4.29 n*M*/mg of mitochondrial protein for TFM and 11.5 n*M* for 2,4-dinitrophenol. The increased oxygen consumption of the mitochondrial preparation is characteristic of uncoupling effects. It is not necessarily attributable to enyzme detoxication. As TFM does disrupt such a universal process as oxidative phosphorylation, different tolerances between species must depend on such factors as permeability of the organism to TFM, ability to detoxify and excrete TFM, and ability of the organism to derive anaerobic energy to endure TFM exposures.

76-2761. Takade, D. Y.; Allsup, T.; Khasawinah, A.; Kao, T. S.; Fukuto, T. R. (Dep. Entomol., Div. Toxicol. Physiol., Univ. California, Riverside, CA 92502). **Metabolism of *O,O*-dimethyl 5-[α (carboethoxy)benzyl] phosphorodithioate (phenthoate) in the white mouse and house flies.** *Pestic. Biochem. Physiol.* 6(4): 367-376; 1976. (15 references)

This report summarizes results of studies on the metabolism of ^{14}C and ^{32}P labels of phenthoate in the white mouse, susceptible house flies, and flies resistant to the closely related organophosphorus insecticide, dimethoate. In the mouse phenthoate was metabolized rapidly to a wide variety of detoxication products and only an insignificant amount of phenthoate oxon was found. In the house fly the same detoxication products were produced but substantial amounts of phenthoate oxon were found. It was concluded from these studies that the selective toxicity of phenthoate between insect and mammal can be attributed to the difference in the accumulation of the oxon.

76-2762. Fitzpatrick, G.; Sutherland, D. J. (Dep. Entomol., Mississippi State Univ., Mississippi State, MS 39762). **Uptake of the mosquito larvicide temefos by the salt marsh snail, New Jersey—1973-74.** *Pestic. Monit. J.* 10(1): 4-6; 1976. (12 references)

Uptake of the mosquito larvicide temefos (temephos, Abate) by the salt marsh snail (*Melampus bidentatus Say*) in New Jersey was measured by gas-chromatographic analysis. Measurable quantities of temefos were found in the snails within 1 day after the first treatment with a 2 percent granular formulation but 3 weeks elapsed before uptake occurred following treatment with a temefos emulsion. Residues in the snails exposed to the granular formulation were generally more than 10 times higher than those in snails exposed to the emulsion although application rates of the granular formulation were only about three times higher than those of the emulsion. Residues in snails exposed to the emulsion fell below detectable levels less than 3 weeks after cessation of treatments although measurable amounts were found in snails exposed to the granular formulation for more than 5 weeks after the last treatment. The persistence of temefos in *M. bidentatus* suggests the potential for its movement through food webs exposed to the granular formulation. (Author abstract by permission)

76-2763. Farag, A.; Kahil, A.; Soliman, M. A. (Fac. Med., Cairo Univ., Cairo, Egypt). **Comparative study of the effect of atropine, P2AM, and buscopan.** *Pharmacology* 14(4): 301-306; 1976. (31 references)

The effect of atropine, hyoscine, belladonna, and hyoscyamus alkaloids was studied on experimental animals intoxicated with parathion. The studies indicated that no significant recovery from parathion poisoning of rats was obtained with any of the following treatments: atropine, 12-50 mg/kg; P2AM (pralidoxime), 25 mg/kg alone, or with atropine, 35 mg/kg, and/or buscopan, 30-60 mg/kg successively; hyoscine, 2-16 mg/kg + atropine 10-80 mg/kg; or total belladonna alkaloids, 12-50 mg/kg, or 25 mg/kg of both beiladonna and atropine. A dose of 70 mg/kg atropine did increase recovery significantly. P2AM potentiated the action of atropine, improving recovery rates. P2AM in conjunction with atropine protected experimental animals more significantly from larger doses of parathion than atropine alone. Hyoscine (in very small doses), total belladonna alkaloids and hyoscyamus alkaloids (better results in small doses), and P2AM (of superior antimuscarine action) are recommended with each of the drugs, atropine, and buscopan, rather than either alone or in combination.

76-2764. Abrams, R. M.; Notelovitz, M.; Wilcox, C. J. (Dep. Ob-Gyn, Univ. Florida, Gainesville, FL 32610). **Stimulation of the pentose cycle by paraquat in isolated perfused rat lungs.** *Physiologist* 19(3): 117; 1976.

The effects of perfusion with paraquat were determined on the glucose metabolism and pentose cycle flux of isolated rat lungs. In control perfusions, the pentose pathway accounted for 13% of a glucose utilization of 44 μmoles/hr/g dry wt. In μmoles/hr/g dry wt, total CO_2 production was 70 and lactate plus pyruvate production was 42 with an L/P ratio of 11. Total CO_2 production was progressively stimulated with increasing perfusate PQ concentration up to 1.5 m*M*. At this PQ concentration, glucose utilization increased 32%, lactate plus pyruvate production increased 28% with no significant change in L/P, and total CO_2 production increased 105%. Partition of the CO_2 derived from glucose indicated 163% increase in production via the pentose pathway while mitochondrial CO_2 production did not change significantly. These studies show marked stimulation of the pentose cycle in the presence of PQ indicating increased turnover of cytoplasmic

NADPH. Reduction of PQ by NADPH may generate reactive species which result in toxic lung injury.

76-2765. Sachsse, K.; Hess, R. (Ciba-Geigy Ltd., Basel, Switzerland). **Exposure of volunteers and animals in aerial application test of phosphamidon (Dimecron 100) in India.** *Proc. Eur. Soc. Study Drug Tox.* 14: 247-253; 1973. (19 references)

The effects of direct exposure of animals and persons to Dimecron 100 (used for control of leafhopper and stemborer in rice fields) were studied. The chemical was sprayed once at double the recommended rate (275 g/ha) from a low-flying airplane onto paddy fields. Tests made before and after spraying revealed no changes in erythrocyte or leucocyte counts or in hematocrit values. Plasma cholinesterase activity was slightly inhibited in humans 3 days after exposure. Mild, transient irritation of the mucous membranes was also noted in most of the people immediately after exposure. The animals which were exposed, 10 head of cattle, 10 goats, and 10 chickens, showed no ill effects.

76-2766. Hunter, J.; Chasseaud, L. F. **Clinical aspects of microsomal enzyme induction.** *IN: Progress in Drug Metabolism,* J. W. Bridges and L. F. Chasseaud, Eds., John Wiley and Sons, London, 1976, p. 129-190. (471 references)

Exposure to certain pesticides has influenced drug metabolism. However, the humans at risk are usually those involved in the usage of large amounts of these materials. The environmental exposure of the human population is considerably less and its effects are therefore more difficult to assess, particularly in the absence of suitably sensitive methods. Studies in patients receiving anticonvulsant therapy have shown that the concentrations of the DDT metabolite, DDE, present in blood and adipose tissue were lowered. This demonstrated that drug therapy can influence the body burden of persistent compounds such as DDT. Studies conducted on the general population demonstrate that their exposure to dieldrin and aldrin is sufficient to produce enzyme induction. The implications of enzyme induction in chemical carcinogenesis remain to be established.

76-2767. Levin, J. O.; Rappe, C.; Nilsson, C. A. (Dep. Organic Chem., Umea, Umea, Sweden). **Use of chlorophenols as fungicides in sawmills.** *Scand. J. Work Environ. Health* 2(2): 71-81; 1976. (25 references)

Analyses of commercial chlorophenol formulations widely used as fungicides in Swedish sawmills revealed the presence of different impurities in the preparations. In the mills the chemicals is applied in solution by means of a spray treatment occurring in the kiln. The treatment is continued year round. There is an enrichment of chlorodibenzofurans in the sawdust in relation to the chlorophenol content, when compared to that in the fungicide used. In the chlorophenol formulation the ratio tetrachlorophenol:chlorodibenzofuran is about 10,000:1; and in the sawdust, about 100:1. The highest contaminant levels occur at the beginning of the feeder line. When dipping, instead of spraying, was used as the method of application, no enrichment of chlorodibenzofurans in the sawdust was noted, but, again, the sawdust of the trimming position had the highest chlorophenol content. A sludge of sawdust collected at the bottom of the dipping tank which was remarkably enriched with chlorinated dibenzofurans. The chlorodibenzofuran content in the sludge is about 10 times higher than that in the chlorophenol formulation used. Analyses indicated that chlorodibenzodioxins may be formed under drying conditions which would make the atmosphere in the kiln poisonous. Thorough ventilation must be required.

76-2768. Statham, C. N.; Melancon, M. J., Jr.; Lech, J. J.* (Dep. Pharmacol., Med. Coll. Wisconsin, Milwaukee, WI 53233). **Bioconcentration of xenobiotics in trout bile: a proposed monitoring aid for some waterborne chemicals.** *Science* 193(4254): 680-681; 1976. (10 references)

A technique is proposed for the monitoring of certain xenobiotic pollutants in suspect aquatic environments by fish bile analysis. Bile removed from rainbow trout (*Salmo gairdneri*) exposed to nine different radioactive compounds in vivo contained concentrations of radioactvity greater than those in the surrounding water. Bile-to-water radioactivity ratios as high as 10,000:1 were found after 24-hour exposures. The results of these experiments suggest that analysis of bile of wild or caged fish from a suspect site may be useful as a qualitative monitoring aid for certain types of xenobiotics in water. (Author abstract by permission. Copyright 1976 by the American Association for the Advancement of Science)

76-2769. Vlassak, K.; Hermans, K. A. H.; Van Rossen, A. R. (Dep. Biotech. Sci., Katholieke Univ. Leuven, Louvain, Belgium). **Dinoseb as a specific inhibitor of nitrogen fixation in soil.** *Soil Biol. Biochem.* 8(2): 91-93; 1976. (16 references)

The action of dinoseb (DNBP) on biological nitrogen fixation or N_2ase activity in a soil system was investigated along with the effects of the pesticide on N_2ase in vitro. DNBP concentrations of 3 parts/10^6 inhibited nitrogen fixation by about 60% and 6 parts/10^6 completely stopped the reaction. As little as 1 part/10^6 DNBP reduced N_2ase activity, indicating a very small absorption effect of the soil on this pesticide. Firm conclusions as to whether the pesticide reduced the growth of the soil bacteria responsible for biological nitrogen fixation, or specifically inhibited N_2ase activity could not be drawn. From the biochemical viewpoint, it is suggested that DNBP may be useful as an inhibitor in N_2ase studies.

76-2770. Ridge, E. H. (CSIRO, Div. Soils, Glen Os-

mond, South Australia 5064). **Studies on soil fumigation. II. Effects on bacteria.** *Soil Biol. Biochem.* 8(4): 249-253; 1976. (13 references)

Fumigation with 220 kg/ha chloropicrin (CP) or with a combined application of 220 kg/ha chloropicrin and 220 kg/ha methyl bromide (F) on a South Australian wheatfield soil, greatly depressed the viable counts of "total" aerobic bacteria and a fluorescent pseudomonads. Within 10 days after the fumigation, however, bacterial numbers rose sharply. For a further 14 days, the fluorescent pseudomonads formed the major part of the aerobic bacterial population counted and over 5 months later their numbers in F-treated soil remained about 10 times higher than in untreated soil. After CP or F treatment, the numbers of aerobic spore-formers rose more slowly, but did remain significantly higher over the 159 days of the trial. Little effect on soil bacterial numbers was noted with fumigation with 220 kg/ha of methyl bromide alone. A random isolate check revealed a predominance of Gram-negative organisms in soil treated with CP. This dominance decreased with time. MB treatment did not yield any detectable change. Smaller proportions of strains antagonistic in vitro to *Gaeumannomyces graminis* var. *tritici* were found in fluorescent pseudomonads from rhizospheres of wheat plants in soil fumigated with CP, than isolates from MB-treated soil or from untreated soil.

76-2771. Ladd, J. N.; Brisbane, P. G.; Bulter, J. H. A.; Amato, M. (CSIRO, Div. Soils, Glen Osmond, South Australia, 5064). **Studies on soil fumigation. III. Effects on enzyme activities, bacterial numbers and extractable ninhydrin reactive compounds.** *Soil Biol. Biochem.* 8(4): 255-260; 1976. (14 references)

Soil enzyme activities were differentially decreased as were viable bacterial numbers by the fumigation of a field soil with chloropicrin and methyl bromide, either singly or in combination. Simultaneously, the amounts of ninhydrin reactive compounds extractable with acidified Tris buffer were increased. Treatment with chloropicrin was more effective than using methyl bromide. Hydrolysis rates of both an amide and a peptide derivative were decreased by chloropicrin treatment and remained low despite activity changes over 325 days. Caseinase activity, although initially decreased by both compounds, recovered to exceed those in untreated soils. Thereafter, caseinase activity of fumigated and untreated soils fluctuated greated, partly associated with seasonal drying of the soils in the field. Chloropicrin markedly depressed viable bacterial populations. This was not true with methyl bromide. Even so, the bacterial populations subsequently increased above untreated soil levels. No consistent relation between the release of ninhydrin reactive compounds following fumigation and changes in bacterial numbers or changes in enzyme activity were noted. In the early stages of amino-nitrogen release in fumigated soils, autolytic reactions are probably important. It may be that net gains in caseinase activity are partly due to the production de novo of extracellular proteases by microorganisms or to the release of intracellular proteases from killed cells.

76-2772. Zemaitis, M. A.; Oberholser, K. M.; Greene, F. E. (Dep. Pharmacol., Sch. Pharm., Univ. Pittsburgh, Pittsburgh, PA 15261). **Effects of acute and chronic dieldrin administration on liver and plasma esterases of the rat.** *Toxicol. Appl. Pharmacol.* 37(1): 29-37; 1976. (23 references)

The administration of a single oral dose of dieldrin, 40 mg/kg, or the feeding of a diet containing 50 ppm of dieldrin for up to 8 weeks to male and female rats produced changes in plasma and liver esterases that were dependent on the type of esterase, the duration of exposure, and the sex of the animal. Two hours after oral administration of dieldrin, plasma carboxylesterase activity declined in males but not in females; hepatic microsomal carboxylesterase activity was also slightly lower in dieldrin-treated males, but not females. Forty-eight and 120 hr after dieldrin administration, hepatic microsomal carboxylesterase activity was elevated in rats of both sexes. After 8 weeks of dieldrin feeding (50 ppm), both plasma and microsomal carboxylesterase activities were significantly elevated in males and females. In most instances, elevations in the activities of hepatic microsomal esterases were due to dieldrin-induced increases in microsomal protein content and not to increased esterase specific activity. Electrophoresis of solubilized microsomal membranes from control and dieldrin-treated animals revealed no sex differences or major dieldrin-induced alterations on esterase isozyme patterns. Plasma cholinesterase activity was significantly reduced in females fed 50 ppm of dieldrin in the diet for 8 weeks. Since the level of activity of this enzyme is regulated in part by estrogen, depression of cholinesterase activity may result from an increased rate of steroid metabolism in dieldrin-treated female rats. Plamsa cholinesterase activity of male rats was unaffected by either acute or chronic dieldrin administration. (Author abstract by permission)

76-2773. Cohen, S. D.; Ehrich, M. (Sect. Pharmacol. Toxicol., Sch. Pharm., Univ. Connecticut, Storrs, CT 06268). **Cholinesterase and carboxylesterase inhibition by dichlorvos and interactions with malathion and triorthotolyl phosphate.** *Toxicol. Appl. Pharmacol.* 37(1): 39-48; 1976. (22 references)

Potentiation of toxicity after exposure to combinations of organophosphates may result from inhibition by one organophosphate of carboxylesterases which either bind or hydrolyze a second organophosphate. To determine the potential of dichlorvos (DDVP) for organophosphate interactions, dose- and time-related inhibition of cholinesterase and carboxylesterase activities were studied in male mice. Brain cholinesterase activities were 37, 36, 40, 69, and 92% of control at 0.25, 0.5, 2, 5, and 18 hr after i.p. injection of 30 mg/kg of DDVP, respectively. DDVP, 35 mg/kg, killed mice in less than 0.5 hr. Eighteen

hours after 30 mg/kg, the hydrolysis by liver of triacetin, diethylsuccinate, and procaine was 82, 52, and 84% of control, respectively. The anticholinesterase action of 800 mg/kg of malathion was not potentiated by pretreatment, 18 hr prior, with 30 mg/kg of DDVP, not did malathion pretreatment potentiate the anticholinesterase action of DDVP. Pretreatment with triorthotolyl phosphate (TOCP), a potent inhibitor of carboxylesterase hydrolysis and organophosphate binding, did not potentiate the anticholinesterase action of DDVP. These results suggest that DDVP neither potentiates nor is potentiated by other organophosphates and that binding is unlikely to be an important detoxification mechanism for DDVP in mice. (Author abstract by permission)

76-2774. Pasquet, J.; Mazuret, A.; Fournel, J.; Koenig, F. H. (Rhone-Poulenc Rech., Cent. Nicolas Grillet, Vitry-sur-Seine, France). **Acute oral and percutaneous toxicity of phosalone in the rat, in comparison with azinphosmethyl and parathion.** *Toxicol. Appl. Pharmacol.* 37(1): 85-92; 1976. (12 references)

The acute oral and percutaneous toxicities and in vivo anticholinesterase activities of phosalone (RP 11 974), azinphosmethyl, and parathion (organophosphorus esters with insecticidal properties) are compared. The oral LD50 in female rats for phosalone was about 110 mg/kg, while those of azinphosmethyl and parathion were, respectively, 4 and 18 times lower. At time of peak effect, the oral ID50 of phosalone for erythrocyte cholinesterase was about 10 mg/kg; azinphosmethyl and parathion were 2 and 10 times more inhibitory, respectively. The differences in percutaneous toxicity of the three compounds were more marked than by the oral route. The acute percutaneous LD50 of phosalone in female rats was about 1500 mg/kg, while those of azinphosmethyl and parathion were close to 90 and 8 mg/kg, respectively. The oxygen analogue of phosalone (RP 12244) was about 4 to 5 times more toxic than the parent compound after a single oral or percutaneous administration to female rats. (Author abstract by permission)

76-2775. Sasmore, D. P.; Kay, D. L.; Newell, G. W.; Spanggord, R. (Stanford Res. Inst., Menlo Park, CA). **Aerosol inhalation studies of five commercial pesticides.** *Toxicol. Appl. Pharmacol.* 37(1): 103-104; 1976.

Five organophosphate pesticides were administered in acute single-dose studies by the oral, intravenous, percutaneous, and respiratory routes. A unique ratioing system was developed to permit the simultaneous exposure of rats in four chambers to ultrasonically or pneumatically nebulized solvent-diluted or neat pesticide. Following treatment, blood and liver concentrations were sought and cholinesterase inhibition was studied. To permit comparison, LC50 values were converted to approximate LD50, i.e., mg/m^3 were converted to mg/kg. This is accomplished by finding the number of milligrams of respired toxicant during a given exposure per kilogram of rat. Our assumptions were 100 respirations/min of 1-ml volume each for a 200-g (1/5 kg) rat. Guyton's formula also can be used: breathing rate (ml/min) = 2.10 × (g of body wt)3/4. If the i.v. LD50 value is considered unity, then in our studies the average oral LD50 was two and not surpisingly the respiratory LD50 (very approximate) was also unity but ranged from 0.4 to 2.3. Reasons for these variations are considered. Percutaneous values were highly variable—from three to 60 times the i.v. LD50. Both cholinesterase inhibition and recovery of pesticide from blood or liver was disappointing, variable, and inconsistent. (Author abstract by permission, abstract no. 28. Abstracts of papers for the Fifteenth Annual Meeting of the Society of Toxicology, Atlanta, Georgia, March 14-18, 1976)

76-2776. Hayes, W. J., Jr. (Cent. Environ. Toxicol., Dep. Biochem., Vanderbilt Univ. Sch. Med., Nashville, TN). **Dosage relationships associated with DDT in milk.** *Toxicol. Appl. Pharmacol.* 37(1): 104; 1976.

Separate reports imply that DDT is more toxic to infant rats if they receive it via their mothers' milk than via stomach tube. Therefore, the effect of DDT in milk was reinvestigated and the study was expanded to include dosage-response measurements. The results were consistent with earlier findings that young rats are no more susceptible than adults to poisoning by DDT and may be more resistant, depending on circumstances. For example, all of one litter remained normal and lively after their mother, dosed at the rate of 200 mg/kg/day, i.p., had died in severe DDT tremor on Day 14 of lactation. A comparison of isomers and potential metabolites in technical DDT and in tissues indicated either lack of absorption or rapid excretion of *o,p'*-isomers, resistance of the blood-brain barrier to *o,p'*-DDT, and the increase of DDD and DDE through metabolism. The concentration of DDT in the brains and whole bodies of pups from dams dosed at 200 mg/kg/day was higher than would be predicted by extrapolation from lower dosages, suggesting relative inability of the dams to metabolize and eliminate the compound at a dosage fatal to some of them. Based on the concentration of DDT in rat milk and on the amount of DDT measured in litters fed exactly 24 hr, it was calculated that rats secreted milk at the rate of 38.7 and 34.5 ml/dam/day when DDT was administered i.p. and p.o., respectively. Based on the analyses of litters, the dams secreked into their milk 12.6 to 30.2% of the DDT administered to them, the mean being 24.6% in those receiving the compound from their diet at an average rate of 32.4 mg/kg/day. (Author abstract by permission, abstract no. 30)

76-2777. Rose, M. S.; Smith, L. L.; Wyatt, I. (Imperial Chem. Ind. Ltd., Centr. Toxicol. Lab., Biochem. Mechanisms Unit, N. Macclesfield, Cheshire, England). **The relevance of free radical formation in rat lung to the mechanism of paraquat toxicity.** *Toxicol. Appl. Pharmacol.* 37(1): 105; 1976.

The herbicidal effects of paraquat and diquat ap-

pear to be related to their reduction to free radicals by photosystems present in green leaves and the subsequent reaction of these free radicals with oxygen to form reactive species of oxygen, such as superoxide and peroxide. A similar mechanism has been put forward to explain the mammalian toxicity of paraquat and, in particular, its specificity towards the lungs. We have investigated the entry of both paraquat and diquat into rat lung and the consequent metabolic effects that result. Paraquat and diquat enter lung cells after intravenous injection into rats and both give rise to an increase in the pentose phosphate pathway for oxidizing glucose, indicating that cycling through the free radical species is occurring in cells with concomitant oxidation of NADPH. However, the stimulation of the pentose phosphate pathway following diquat is as great, if not greater than that observed following paraquat yet only the lungs of paraquat-poisoned rats are damaged. We therefore conclude that the relationship between free radical generation and lung damage is not simple, and that the mechanism of damage may be related to oxidation of NADPH and subsequent depletion of cellular energy in those cells accumulating paraquat, rather than the production of reactive species of oxygen. (Author abstract by permission, abstract no. 31)

76-2778. Griffin, T. B.; Coulstan, F.; McCollister, D. D. (Int. Cent. Environ. Safety, Holloman Air Force Base, NM). **Studies of the relative toxicities of chlorpyrifos and chlorpyrifosmethyl in man.** *Toxicol. Appl. Pharmacol.* 37(1): 105; 1976.

The oral toxicities of chlorpyrifos [*O,O*-diethyl *O*-(3,5,6-trichloro-2-pyridyl) phosphorothioate] and chlorpyrifos-methyl [*O,O*-dimethyl *O*-(3,5,6-trichloro-2-pyridyl) phosphorothioate] were studied in human volunteers to establish no-effect dose levels with respect to anticholinesterase activity in blood and to compare the human data with results previously obtained in rhesus monkeys. When administered to male and female monkeys for 6 months at 0.08, 0.40, or 2.0 mg/kg daily, chlorpyrifos depressed plasma cholinesterase in all dosed groups but reduced erythrocyte cholinesterase only in the two groups receiving the highest doses. Monkeys given chlorpyrifos-methyl at 0.1, 0.2, 1.0, or 5.0 mg/kg daily for 6 months had reduced plasma and erythrocyte cholinesterase activity at the two higher dose levels. Brain cholinesterase was not depressed in any of the monkeys receiving either compound, nor was there any evidence of cholinergic responses, clinical effects, or morphological effects. Chlorpyrifos given to human volunteers at either 0.014, 0.030, or 0.100 mg/kg daily for periods up to 4 weeks elicited significantly plasma cholinesterase inhibition only at the high dose level. Erythrocyte cholinesterase activity was unchanged in all dosage groups. In a similar study in which chlorpyrifos-methyl was given to human volunteers daily at either 0.03 or 0.10 mg/kg for 4 weeks, there was no depression of either plasma or erythrocyte cholinesterase at either dose level. Judging from a large panel of clinical observations, there was no other evidence of toxicity in either of the human studies. (Author abstract by permission, abstract no. 32)

76-2779. Ehrich, M.; Ouellette, R.; Cohen, S. D. (Sch. Pharm., Univ. Connecticut, Storrs, CT). **Toxicologic interactions involving dichlorvos (DDVP).** *Toxicol. Appl. Pharamcol.* 37(1): 105-106; 1976.

DDVP, malaoxon (MX), and paraoxon (PX) bind to noncritical sites in mammalian tissues and this binding can be blocked by prior treatment with triorthotolyl phosphate (TOCP, TOTP). TOTP inhibition of binding potentiated the toxicity of MX and PX but not of DDVP. This study was done to further study DDVP's potential for interacting with other toxicants. Male mice were fed dieldrin (16 mg/kg, p.o.) was sacrificed 4 days later. Liver binding in vitro of MX and PX were increased approximately 50%. DDVP binding was unaffected. DDT (50 mg/kg, i.p.) given 4, 3.5, and 2.5 days prior to sacrifice increased DDVP binding 30% but not that of MX or PX. In similarly treated mice, neither DDT nor dieldrin affected DDVP's in vivo anticholinesterase (antiCHE) action, yet pentobarbital sleep time was decreased. DDVP (30 mg/kg, i.p.) and methyl iodide (135 mg/kg, p.o.) reduced liver glutathion (GSH) concentrations by 20% within 30 min, and 53% within 1 hr, respectively. However, methyl iodide given 1 hr prior to DDVP did not alter DDVP's antiCHE action, suggesting that, in mice, most DDVP detoxification is not GSH-dependent. Combined inhibition of binding and GSH-dependent detoxification by TOTP (125 mg/kg, i.p.) and methyl iodide (135 mg/kg, p.o.), given 18 hr and 1 hr, respectively, prior to DDVP did not affect DDVP's antiCHE action. Hepatic A-esterase activity was determined to be 1160±60 nmol DDVP metabolized/g/min ($X \pm SE$, $n=6$) and may be sufficient to account for DDVP detoxification when both the binding and GSH pathways are blocked. In addition, DDVP (25 mg/kg, i.p.) potentiated the antiCHE action of MX (10 mg/kg, i.p.) given 0.5 hr after pretreatment. This was associated with a 68% reduction in hepatic MX binding after DDVP. Thus, DDVP toxicity was not altered by the other toxicants tested but it potentiated MX toxicity. (Author abstract by permission, abstract no. 33)

76-2780. Cagen, S. Z.; Janoff, A. S.; Gibson, J. E. (Dep. Pharmacol., Michigan State Univ., East Lansing, MI). **Effect of paraquat (methyl viologen) on liver function in mice.** *Toxicol. Appl. Pharmacol.* 37(1): 106; 1976.

Paraquat poisoning may result in pulmonary damage and hepatoxicity. To examine the effect of paraquat on liver function, paraquat-treated mice were injected with sulfobromophthalein (BSP; 100 mg/kg) or indocyanine green (ICG; 20 mg/kg) via the tail vein and plasma concentrations of these compounds were determined at various times afterwards. In addition, hexobarbital sleeping time determinations were made following paraquat poisoning as were determinations of hepatic concentrations of reduced glutathione (GSH). BSP was retained in the plasma

24 but not 48 or 72 hr following paraquat. Significant plasma retention of ICG was also observed 24 hr following paraquat, hexobarbital sleeping time was unaffected by paraquat treatment. Body temperature of the poisoned mice was significantly depressed 24 hr following treatment, and it was subsequently observed that the paraquat-induced ICG plasma retention could be reversed by warming the paraquat-treated mice to normal body temperature. In contrast, paraquat caused BSP plasma retention independent of body temperature. Furthermore, hepatic GSH concentrations were reduced 24 and 36 but not 12, 48, or 72 hr following paraquat treatment. Thus, the retention of BSP in the plasma may have been secondary to the reduction of hepatic GSH concentrations. (Author abstract by permission, abstract no. 34)

76-2781. Kurtz, P. J. (Toxicol. Div., U.S. Army Environ. Hyg. Ag., Aberdeen Proving Ground, MD). **Behavioral toxicity of pesticides: physiological and behavioral effects of a carbamate compound.** *Toxicol. Appl. Pharmacol.* 37(1): 106; 1976.

Decreases in rat plasma, erythrocyte, and brain cholinesterase activities after intraperitoneal injection of 1 to 5 mg/kg of 4-benzothienyl- *N*-methyl carbamate (Mobam) were compared with decrements in spontaneous motor activity and changes in performance of a rapidly acquired conditioned avoidance response produced by this compound. Significant effects were observed with all five measures at dosages producing no obvious clinical signs. A dosage of 2 mg/kg significantly depressed plasma and erythrocyte cholinesterase activity and decreased motor activity 15 min after injection, but only higher dosages (3 and 5 mg/kg) significantly depressed brain cholinesterase activity and avoidance performance. One possible explanation for these findings is that the depression in spontaneous motor activity found with the lower dosages is related to peripheral nervous system cholinesterase inhibition while the effects of higher dosages on avoidance performance are related to depressed brain cholinesterase activity. This hypothesis is currently being examined with regard to the effects of the organophosphorus insecticide, malathion. (Author abstract by permission, abstract no. 35)

76-2782. Montgomery, M. R. (Dep. Pharmacol., Univ. Minnesota, Minneapolis, MN). **Interaction of paraquat with pulmonary microsomal enzyme systems.** *Toxicol. Appl. Pharmacol.* 37(1): 106-107; 1976.

We have previously reported on the inhibition of pulmonary, microsomal fatty acid desaturase activity following acute in vivo treatments of rats with the herbicide paraquat (methyl viologen). In preparations of lung microsomes that are free of contaminating hemoglobin, superoxide anion radical is generated at pH 7.4 in the presence of 300 μM epinephrine and 1 mM NADPH. The generation of this potentially toxic species is increased 75% by the in vitro addition of 0.5 mM paraquat, but there is no stimulation of this effect by acute in vivo paraquat treatment. Both the basal O_2-generation and the paraquat-stimulated generation of topic concentrations of H_2O_2 is increased threefold by the in vitro addition of 0.1 mM paraquat to control microsomal preparations; however, again there is no additional effect of acute in vivo paraquat administration. Upon investigation of the enzymes responsible for the destruction of these materials, washed hemoglobin-free lung microsomes were found to contain a significant concentration of catalase activity which is unchanged either 24 hr or 4 days after paraquat administration. Superoxide dismutase activity could not be detected in washed lung microsomes, even 4 days after paraquat administration. However, superoxide dismutase activity was found in hemoglobin-free microsomes prepared from both kidney and liver. If microsomal membranes are the cellular site of paraquat reduction via NADPH reductase with the subsequent generation of O_2 then this lack of microsomal superoxide dismutase activity in lung microsomes may be responsible for the pulmonary specificity of this chemical. (Author abstract by permission, abstract no. 36)

76-2783. Jorgenson, T. A.; Rushbrook, C. J.; Newell, G. W. (Stanford Res. Inst., Menlo Park, CA). **In vivo mutagenesis investigations of ten commercial pesticides.** *Toxicol. Appl. Pharmacol.* 37(1): 109; 1976.

The Environmental Protection Agency now is conducting a thorough review of the implications of using alternate chemicals for pest control, including older registered pesticides. The EPA strategy program includes laboratory studies to obtain additional data. One of these programs is directed toward gathering mutagenesis data. Information presented here represents one part of such a program-extensive dominant lethal tests of folpet, captan, methyl parathion, parathion, malathion, bromacil, guthion, azodrin, pentachloronitrobenzene (PCNB), and phorate. Male mice were distributed into groups of 20 males each. Treatment was in the diet for 7 weeks at three dose levels. Reference controls were included as well as a positive control group receiving triethylene melamine in the drinking water for 4 weeks. Following treatment, each male was mated to two adult females weekly for 8 weeks. All the data was subjected to rigorous statistical analysis using a specifically designed computer program. No consistent responses occurred to suggest that any of the 10 pesticides was mutagenic to the mouse by the dominant lethal procedure. It is concluded that folpet, captan, parathion, methyl parathion, malathion, phorate, azodrin, guthion, PCNB, and bromacil in the diet for 7 weeks do not induce dominant lethal effects in mice. (Author abstract by permission, abstract no. 41)

76-2784. Simmon, V. F.; Poole, D. C.; Newell, G. W. (Stanford Res. Inst., Menlo Park, CA). **In vitro mutagenic studies of twenty pesticides.** *Toxicol. Appl. Pharmacol.* 37(1): 109; 1976.

As part of the Environmental Protection Agency's substitute pesticide program extensive mutagenic studies are being conducted on many pesticides. In the current study, 20 pesticides were evaluated for their mutagenic potential in four microbial assay systems. The 20 pesticides, tested are folpet, captan, methyl parathion, parathion, malathion, bromacil, guthion, azodrin, pentachloronitrobenzene (PCNB), phorate, dinoseb, dursban (chlorpyrifos), monuron, monosodium methanearsonate (MSMA), disodium methane arsonate (DMSA), cacodylic acid, fenthion, trifluralin, methomyl, and simazine. The microbial assay systems used are the histidine reverse mutation system in five strains of *Salmonella typhimurium*, an assay of mitotic recombination in a diploid strain of *Saccharomyces cerevisiae*, and relative toxicity assays in *Escherichia coli* and *Bacillus subtilis*. A mammalian metabolic activation system using the liver of rats which had been treated with Arochlor 1254 was used in all of the assays except the *B. subtilis* assay. Folpet, captan, and bromacil were mutagenic in all of the assays. Azodrin, cacodylic acid, and guthion increased mitotic recombination in *S. cerevisiae*. Dursban and dinoseb were more toxic in repair deficient strains of *B. subtilis* and *B. coli* than in repair proficient strains of these organisms. (Author abstract by permission, abstract no. 42)

76-2785. Chadwick, R. W.; Simmons, W. S.; Bryden, C. C.; Chuang, L. T.; Key, L. M.; Chadwick, C. J. (Environ. Protect. Ag., Research Triangle Park, NC). **Effect of dietary lipid on lindane metabolism.** *Toxicol. Appl. Pharmacol.* 37(1): 113-114; 1976.

The detoxification of pesticides by the hepatic microsomal enzymes has a well-known phospholipid dependence. Varying the type of dietary lipid alters the microsomal membranes and could cause significant changes in the metabolism of these toxicants by the membrane-bound enzyme complexes of the liver and other organs. This study examined the influence of feeding lipids with different fatty acid compositions on the storage and metabolism of lindane, the hepatic cytochrome P-450 content, microsomal protein content, microsomal phospholipid content and the fatty acid composition of phosphatidylcholine (PC) and phosphatidyl ethanolamine (PE). Female weanling rats were fed fat-free diets supplemented with either 7% hydrogenated coconut oil, 7% peanut oil, 5½ menhaden oil plus 2% linseed oil, or the unsupplemented diet for 12 days prior to treatment with lindane. Then all rats received a daily p.o. dose of 2.5 mg of lindane for 6 days. On day 7 the animals were dosed with 2.5 mg of lindane (containing 2 μCi of [^{14}C]lindane) in place of the previous treatment and they were sacrificed 24 hr later. The diet containing the menhaden-linseed oil combination produced an early marked effect on the self-induced metabolism of lindane. Within 24 hr after receiving lindane the rats on this diet excreted signifantly higher amounts of chlorophenol metabolites than the rats fed the other diets. Though metabolism of lindane to the chlorophenols was still increasing on Day 3, the difference between the rats fed to menhaden-linseed oil diet and those fed the other diets was less marked. By the last day, no significant treatment effects on the excretion of individual chlorophenols were observed. However, significantly higher radioactivity in the residual urine of the rats fed the menhaden-linseed oil diet, suggests the possibility of an altered metabolic pathway at this point. On the final day there were no significant differences in liver weight, microsomal protein content, or the in vitro metabolism of lindane to hexachlorocyclohexene. The P-450 content of the rats on the fat free diet was significantly less than that of the others. The microsomes from the animals on this diet also had a lower percentage of PE and a higher PC/PE ratio than the other rats in the study. The present investigation indicates that significant changes in the self-induced metabolism of lindane can result from the feeding diets containing lipids with different fatty acid compositions. (Author abstract by permission, abstract no. 52)

76-2786. Iverson, F.; Newsome, H. (Health Protect. Br., Foods Directorate, Tunney's Pasture, Ottawa, Ontario, Canada). **Tissue distribution, decline, and metabolic studies on decomposition products of ethylenebisdithiocarbamates.** *Toxicol. Appl. Pharmacol.* 37(1): 114; 1976.

Ethylenethiourea (ETU) and ethylenethiuram monosulfide (ETM) are degradation products of the ethylenebisdithiocarbamate fungicides. While ETU has been shown to possess teratogenic activity, other toxicological data for these compounds is lacking. The acute, oral LD50 of ETM for male Sprague-Dawley rats was 230 (178-299) mg/kg. Male and female rats given a single i.p. dose of 5 mg/kg [^{14}C]ETM excreted approximately 85% in the urine within 24 hr. Fecal excretion was negligible. With [^{35}S]ETU, a single 5 mg/kg i.p. dose yielded a mean tissue half-life (t) of 6.3 hr for blood, heart, lung, kidney, liver, spleen, fat, muscle, and brain, while the thyroid was 35 hr. Similar results were obtained after ETM administration. After daily oral dosing of ETU or ETM at 5 mg/kg for 7 days, thyroids contained the highest concentration of radioactivity followed by kidney. Concentrations in liver, brain, heart, spleen, muscle, and lung were similar for both compounds and the lowest concentration occurred in fat. Metabolism of ETU was negligible with 98% of the urinary radioactivity present as ETU and < 1% represented by ethyleneurea (EU). On the other hand, ETM was readily metabolized with ETU and EU representing 31 and 11%, respectively, of the urinary radioactivity. At least three other unidentified metabolites were also present. Incubation of ETM with a fortified microsomal preparation or a 105,000g supernatant fraction produced only small amounts of ETU. Addition of reduced glutathione to the supernatant fraction increased formation of ETU. (Author abstract by permission, abstract no. 53)

76-2787. Fulfs, J. C.; Abraham, R. (Cent. Exp. Pathol. Toxicol., Albany Med. Coll., Albany, NY). **Effects of**

mirex and chloroquine on PCB-induced hepatic porphyria in the rat. *Toxicol. Appl. Pharmacol.* 37(1): 119-120; 1976.

As a continuation of previous work, PCB (Aroclor 1221) and mirex were given to rats by oral gavage for up to 17 months: Group I, PCB (25 mg/kg); Group II, mirex (1.5 mg/kg); Group III, PCB (25 mg/kg) and mirex (1.5 mg/kg); and Group IV, corn oil. Hepatic centrilobular hypertrophy was initially observed at 3 months in all experimental groups but was most marked in Group III. This condition was enhanced at 6 and 17 months and in Group III hypertrophy of hepatocytes extended into the midzonal regions with occasional focal necrosis. Hepatocytes in the centrilobular area contained granules in Groups I and III, which were first noted at 6 months; their number increased with time. Lysosomal acid phosphatase activity was present at similar sites as the granules. These granules were identified as porphyrins as determined histochemically and biochemically. Ultrastructurally, the porphyrins appeared as dense granular inclusions within single membrane-bound vacuoles which contained acid phosphatase activity (lysosomes) and were localized near bile canaliculi. Group II livers had no such granules. At 17 months, an increase in porphyrin granules was observed in Group I and III. In Group III, however, these granules extended throughout the liver lobule. While mirex appeared to have enhanced for formation and retention of porphyrins in lysosomes in Group III, chloroquine had the exact opposite effect. Twenty-four hours following chloroquine treatment, there was a complete absence of "porphyrin-laden lysosomes," suggesting a rapid labilization and exocytosis of these structures. Proliferation of smooth endoplasmic reticulum was noted in all experimental groups that was accompanied by a loss of glucose-6-phosphatase activity. (Author abstract by permission, abstract no. 67)

76-2788. Wills, J. H.; Groblewski, J.; Ngatia, J.; Vitorovic, S. L.; Coulston, F. (Inst. Compar. Hum. Toxicol., Albany Med. Coll., Albany, NY). **Comparison of inhibitions of esterases and alterations of function by several organophosphorus compounds.** *Toxicol. Appl. Pharmacol.* 37(1): 120; 1976.

Seven organophosphorus compounds, including diethquinalphione, fenthion, oxofenthion, phenamiphos, and phoxim, have been compared for abilities to inhibit various esterases (true and pseudo-cholinesterases [ChE], triacetinesterase [TACE], and diethylsuccinate esterase [DESE]) and to alter normal functions. In general, the esterases of the liver seem to be the best indicators of access by these compounds to the functional systems of the animal body. Diethquinalphione was by far the most potent inhibitor of the ChE of the liver, phenamiphos, followed by oxofenthion and fenthion, ranking next. Phoxim, NTN 2925 (methyl isopropylamido 2-nitro-*p*-tolyl thionophosphonate), and NTN 5006 (ethyl isopropylamido 2-nitro-*p*-tolyl thionophosphonate) were comparatively ineffective inhibitors of this ChE. Diethquinalphione, fenthion, and oxofenthion inhibited the ChE of the liver more than they affected either of the other esterases. Phenamiphos, NTN 2925, and NTN 5006 inhibited the TACE of liver more than the ChE. The last two compounds inhibited the DESE of the liver more than its TACE. Nemacur is the only compound that diminished neuromuscular transmission significantly. Moderate doses of Nemacur elevated the voltage threshold of the medullary inspiratory area also. This compound was the most typically cholinomimetic of the seven, its mascarinic effects being antagonized well by atropine. NTN 5006 produced delayed neurotoxic effects in the chicken after an i.p. dose of 200 mg/kg, whereas its methylated homolog, NTN 2925, did not produce this type of effect after a dose of 1000 mg/kg. Single doses of both compounds produced slight histologic changes in the ascending and descending tracts of the spinal cords of the rat and the cat, but no visible weakness. The other compounds have not been examined for this sort of action. For all seven compounds, the initial, immediate toxic effects seem to result primarily from peripheral, pseudocholinergic actions that are not correlated precisely with the ability to inhibit any of the esterases studied in any of the tissues or organs examined. (Author abstract by permission, abstract no. 68)

76-2789. Rosenstein, L.; Chernoff, N. (Health Effects Res. Lab., Exp. Biol. Div., Research Triangle Park, NC). **Spontaneous and evoked ECG changes observed in neonatal rats following in utero exposure to Baygon.** *Toxicol. Appl. Pharmacol.* 37(1): 130; 1976.

Baygon (propoxur) is a common constituent of household pesticides. Therefore, large numbers of pregnant women are exposed to this compound. Thus the purpose of this investigation was to evaluate possible CNS effects on the neonatal rat (Sprague-Dawley) following in utero exposure. In this experiment, dams received either a control diet or 100 ppm of Baygon mixed with their feed. Treatment began on Day 2 of gestation and continued throughout parturition until weaning. Prior to weaning, Baygon-treated neonates weighed significantly less than controls. Baygon neonates also exhibited a significant delay in the onset of the startle reflex. There was no difference noted in the onset of the righting reflex nor any difference in the percentage litter viability. At 24 days of age, the litters were divided into males and females and electroencephalogram (EEG) and visual evoked potentials (VEP) were obtained. Baygon neonates showed a significantly greater increase in the degree of delta- and alpha-wave activity along with an increase in bilateral symmetry. A significant sex effect also was noted in these wavebands. Analysis of the EEG power spectrum for various frequency bands, however, revealed no significant dose effect. On the other hand, VEP for treated males and females reflected differences, particularly in the primary and secondary response portions. The quiescent phase, however, did not appear altered. It is thus apparent that there is some degree of CNS impairment in neonates. Whether this involvement is reversible or even significant in later life is an unresolved question. (Author abstract by permission,

abstract no. 93)

76-2790. Berteau, P. E.; Deen, W. A. (Univ. California, Sch. Pub. Health, Naval Biomed. Res. Lab., Naval Supply Cent., Oakland, CA). **Changes in whole blood serotonin concentrations in rats exposed to insecticide aerosols.** *Toxicol. Appl. Pharmacol.* 37(1): 134; 1976.

In order to assess the potential hazard to workers engaged in ultra-low-volume application of pesticides, we initiated studies of inhalation toxicity using female rats and standard liquid formulations of vegetable oil (control), chlorpyrifos, malathion, naled, and resmethrin. Because whole blood concentrations of serotonin (5-hyroxytryptamine) are reported to be elevated in animals under stress, we used changes in this concentration as one biochemical parameter of toxicity. Small particle aerosols (1-3 μm), generated by refluxing Wells atomizers, were allowed to enter an exposure chamber containing the animals. The aerosols were sampled at intervals on membrane filters to determine particle concentration. Dosages were estimated by the formula concentrations × exposure time × breathing rate (0.65 ml/min/g) × whole body retention (21%). Serotonin concentrations were not elevated following exposure to soya-bean oil or to chlorpyrifos (38 mg/kg) but were significantly ($p < 0.05$) elevated following exposure to malathion (71 mg/kg) but were significantly ($p < 0.05$) elevated following exposure to malathion (71 mg/kg), naled (5.0 mg/kg), and resmethrin (35 mg/kg). Return to preexposure values was achieved after 24 hr with malathion, 7 days with naled, and 14-21 days with resmethrin. This elevation of whole blood serotonin in rats appears to be due to factors other than stress of handling and exposure. The elevation may be related to the action of the pesticides on the nervous system. (Author abstract by permission, abstract no. 101)

76-2791. Sauerhoff, M. W.; Braun, W. H.; Blau, G. E.; LeBeau, J. E. (Toxicol. Res. Lab., Dow Chem. Co., Midland, MI). **The fate of 2,4-dichlorophenoxyacetic acid (2,4-D) following oral administration to man.** *Toxicol. Appl. Pharmacol.* 37(1): 136-137; 1976.

The pharmacokinetic profile of 2,4-D is defined in man. Five male human volunteers ingested a single dose of 5 mg/kg 2,4-D without detectable clinical effects. Concentrations of 2,4-D were determined in plasma in three of five subjects and in urine in all subjects at intervals after ingestion. The elimination of 2,4-D from plasma in all subjects occurred by an apparent first-order rate process with an average half-life of 11.7 hr. All subjects excreted 2,4-D from the body in the urine with an average half-life of 17.7 hr. 2,4-D was excreted mainly as 2,4-D (82.3%) with smaller amounts excreted as a 2,4-D conjugate (12.8%). Essentially all of the 2,4-D is absorbed from the gastrointestinal tract in man. There is no evidence that clearance of 2,4-D from the plasma or excretion from the body involve nonlinear kinetics. (Author abstract by permission, abstract no. 107)

76-2792. Pollock, G. A.; Kilgore, W. W. (Dep. Environ. Toxicol., Univ. California, Davis, CA). **The metabolism of toxaphene components.** *Toxicol. Appl. Pharmacol.* 37(1): 138-139; 1976.

Toxaphene is a chlorinated hydrocarbon insecticide synthesized by the chlorination of camphene. It is a very complex mixture of compounds containing primarily polychlorobornanes and polychlorodihydrocamphenes. Female rats were orally intubated with [^{14}C]toxaphene and several isolated toxaphene components. The animals were housed in glass metabolism chambers and the urine and feces were collected and extracted. The extracts were spotted and developed on TLC plates and analyzed by a combination of TLC scanning and liquid scintillation counting. In addition, in vitro metabolism using liver homogenates was studied. The results show that there are differences in the excretion between some of the toxaphene components. These differences could be due to the metabolism of the various toxaphene components. Thus, these results raise questions about the possible selective accumulation of specific components within the parent mixture. An experimental model using selected purified components will be presented. (Author abstract by permission, abstract no. 112)

76-2793. Ebron, M.; Courtney, K. D. (Environ. Protect. Agency, Research Triangle Park, NC). **Difference in 2,4,5-T distribution in fetal mice and guinea pigs.** *Toxicol. Appl. Pharmacol.* 37(1): 144-145; 1976.

2,4,5-T (2,4,5-trichlorophenoxyacetic acid) administered to pregnant mice was assayed in maternal and placental tissue and fetuses. Maternal blood and tissue concentrations peaked at 8 hr after a dose of 100 mg/kg, which was almost entirely eliminated by 72 hr. After four daily administrations of 100 mg/kg, the 2,4,5-T accumulated in maternal tissues and fetuses. The excretion rate was about 10% of the administered dose on Day 1. After multiple dosing, the mice were excreting about 0.65 mg/24 hr, which resulted in accumulation of 2,4,5-T. Autoradiographs of the whole fetuses showed that initially 2,4,5-T was mainly in the highly vascularized tissue of the fetus. At 48 hr, the 2,4,5-T was still detectable throughout the fetus. In contrast to the slow excretion of 2,4,5-T from the mouse, it is very rapidly excreted from the pregnant guinea pig. Following a single oral dose, approximately 50% of the dose is excreted within 15 hr. This rapid rate prevented 2,4,5-T from reaching the fetus. One hour after administration of 2,4,5-T to the mother, the fetal concentrations were undetectable. Fetal guinea pigs injected in utero eliminated 2,4,5-T about as rapidly as the mothers. (Author abstract by permission, abstract no. 127)

76-2794. Highman, B.; Gaines, T. B.; Schumacher, H. J. (Univ. Arkansas Coll. Med., Little Rock, AR). **Renal alkaline phosphatase activity in fetal offspring of maternal mice given 2,4,5-trichlorophenoxyacetic acid.** *Toxicol. Appl. Pharmacol.* 37(1): 145; 1976.

A teratologic study (*Gaines et al., Toxicol. Appl. Pharmacol.* 33, 174, 1975) revealed an increased incidence of fetal abnormalities in maternal mice given 2,4,5-trichlorophenoxyacetic acid (2,4,5-T). To study possible abnormalities in fetal renal alkaline phosphatase development which is incomplete at birth in mice, 62 maternal mice received 2,4,5-T by gavage on Days 6 through 14 of pregnancy and 38 controls received the vehicle without 2,4,5-T. At necropsy on Day 17, a block containing both kidneys was excised from each of 512 fetuses and fixed 24 hr in cold 65% ethanol. Paraffin sections were cut longitudinally through both fetal kidneys and stained for alkaline phosphatase by the cobalt sulfide method of Gomori. Alkaline phosphatase activity was found mainly in tubules in the inner cortex. Fetuses showing no or slight activity were designated subnormal, as were maternal mice with over 50% subnormal fetuses. Dihybrid cross F_2 mice were used in four of six experiments and F_1 hybrids and CD-1 mice were each used in one. Six of 20 CD-1 mice received 60 mg/kg, 8 CD-1 and 26 of 70 F_2 mice recieved 120 mg/kg, and 9 F_2 and 6 F_1 mice received 90 mg/kg of 2,4,5-T. The respective incidence of maternal and fetal subnormals in CD-1 mice was 0 and 22% in controls, 50 and 52% after 60 mg/kg of 2,4,5-T, and 75 and 86% after 120 mg/kg of 2,4,5-T. In F_1 mice, the respective incidence was 25 and 45% in controls, and 100 and 92% after 90 mg/kg and 30 and 33% in controls, and 81 and 74% after 120 mg/kg of 2,4,5-T. These differences between controls and 2,4,5-T-treated mice are statistically significant and indicate that 2,4,5-T may retard development of fetal renal alkaline phosphatase activity. (Author abstract by permission, abstract no. 128)

76-2795. McConnell, E. E.; Moore, J. A. (Nat. Inst. Environ. Health Sci., Research Triangle Park, NC). **The comparative toxicity of chlorinated dibenzo-*p*-dioxin isomers in mice and guinea pigs.** *Toxicol. Appl. Pharmacol.* 37(1): 146; 1976.

Chlorinated dibenzo-*p*-dioxin may be formed in the production of technical chlorinated phenols. 2,3,7,8-Tetrachlorodibenzo-*p*-dioxin (TCDD), an extremely toxic compound, has been extensively studied subsequent to being identified as a contaminant of trichlorophenoxy acid herbicides (trichlorophenols are used in their synthesis). The purpose of this paper is to present parameters of toxicity of other dibenzodioxin isomers, some of which are also contaminants of chlorinated phenols or products derived from them. TCDD was the most toxic of the isomers studied, although 1,2,3,7,8-pentachlorodibenzo-*p*-dioxin was almost as toxic. 1-NO_2-2,3,7,8 TCDD was more toxic than 1-NH_2-2,3,7,8. Hexachloro isomers were less toxic than the tetra and penta's and the trichloral isomers were the least toxic of all. Pentachloro-predioxins did not produce demonstrable effects even at 50,000 times the LD50-30 of TCDD. The lesions produced by the various isomers were consistent within a given animal species. Thymic and testicular lesions were found in both species. Subcutaneous edema, ascites, and hepatic lesions were characteristically found in dead mice, but not in guinea pigs. Adrenal cortical hemorrhage was a characteristic finding in guinea pigs, but was never observed in mice. Porphyria, as evidenced by fluorescence of various tissues under ultraviolet light, was observed in mice, but not in guinea pigs. Serum protein analysis showed discrepancies in mice only. Total serum protein was decreased due to lower levels of albumin. The alpha- and beta-globulin fractions were decreased, but gamma levels were within normal limits. Toxicity appears to be correlated in part with the degree of chlorination at the 2,3,7, or 8 position. Regardless of the isomer used, guinea pigs were more sensitivie than mice to the lethal effects. (Author abstract by permission, abstract no. 130)

76-2796. Moore, J. A.; Harris, M. W.; Albro, P. W. (Nat. Inst. Environ. Health Sci., Research Triangle Park, NC). **Tissue distribution of [^{14}C]tetrachlorodibenzo-*p*-dioxin in pregnant and neonatal rats.** *Toxicol. Appl. Pharmacol.* 37(1): 146-147; 1976.

2,3,7,8-Tetrachlorodibenzo-*p*-dioxin (TCDD) is teratogenic and fetotoxic. In addition, postnatal studies suggest a toxic sensitivity of neonates to low doses of TCDD administered to the mother. The objective of a series of experiments to be reported is to determine the extent that TCDD gains access to the fetus or neonate following administration of TCDD to the mother. In all experiments, 5 μg/kg of [^{14}C]TCDD (sp act 147 mCi/mmol) was administered in a single oral dose to Fischer 344 rats. The ^{14}C content of tissue was determined by oxidation in a Beckman Biological Oxidizer, trapping CO_2 in a liquid cocktail, and counting using standard liquid scintillation techniques. Tissues were examined on gestation days 14, 18, or 21, or postnatal days 3, 7, 10, or 14. Cross fostering procedures were used to distinguish the amount of TCDD received by placental transfer or milk. Low concentrations of TCDD were present in the fetus at all time periods sampled. Selective compartmentalization as evidenced by increased radioactivity in fetal liver was first seen on gestation day 21. In postnatal experiments, high concentrations of TCDD were found at all time periods. This finding signifies continuous mobilization of TCDD from maternal tissue and ultimately its secretion in milk. The relatively "high" TCDD concentrations found in the neonate (expressed in μg/kg) when contrasted to the dose administered to the mother would significantly account for increased neonatal sensitivity. (Author abstract by permission, abstract no. 131)

76-2797. Stevens, J. T.; DiPasquale, L. C.; Famer, J. D. (Environ. Toxicol. Div., Environ. Protect. Ag., Research Triangle Park, NC). **The acute inhalation toxicology of cacodylic acid.** *Toxicol. Appl. Pharmacol.* 37(1): 165-166; 1976.

Although much information is available on the toxicity of cacodylic acid, a contact herbicide, no data is available in the open literature on its toxicity after inhalation exposure. The commercial formulation Phytal 138

(Ansul) was generated as an aerosol or as a dust. Young adult Sherman rats and Swiss-Webster mice were used in all experiments. No rat mortality was observed 14 days after a 2-hr exposure to a dust aerosol with a mean chamber concentration of 2600 mg/m³ and a particle size of 3 μm (MMD). Nasal, eye, and skin irritation were observed. However, a mean chamber concentration of 1170 mg/m³ for 5 min did not produce signs of respiratory irritation as measured by whole body plethysmography. Male and female rats and mice exposed to low chamber concentrations of Phytar 138 (70 to 91 mg/m³) hr, sacrificed at 3 and 24 hr postinhalation exposure exhibited an initial decrease in glutathione content at 3 hr postexposure (25 and 40% lung and 52 and 30% liver of the male rat and mouse, respectively, but not the female) followed by a rebound after 24 hr to control level or above. Pulmonary microsomal benzphetamine *N*-demethylase was inhibted by 30 and 66% in the male rat and mouse, respectively, at 3 hr; with hepatic metabolism being reduced at 24 hr. Absorption from the lung after intratracheal administration was rapid. At 72 hr, 88.4% of the intravenous dose of [^{14}C]cacodylic acid could be accounted for; 47.8% being eliminated in the urine, 12.5% in the feces, 12.4% found in RBC fraction of blood and the remainder found in the liver, lung, and kidney. Of the label associated with lung, and kidney, 1 hr postintravenous administration, 32%, 11%, and 4.7%, respectively, could not be removed using the procedure of Jollow et al. However, recovery of [^{14}C]cacodylic acid after in vitro incubation with liver and lung subfractions indicated minimal conversion. Rats subjected to high concentration of cacodylic acid via the inhalation route did not exhibit any significant signs of toxicity. Biochemical changes occurred at low doses. Cacodylic acid is eliminated rapidly after intravenous administration; however, ^{14}C-material is concentrated in the red blood cell fraction of the blood. Although in vitro metabolism studies do not suggest significant conversion of cacodylic acid, strong binding to tissues was observed. (Author abstract by permission, abstract no. 178)

76-2798. Goyings, L. S.; Glenn, M. W.; Johnston, R. L.; Kakuk, T. J.; Swenberg, J. A. (Agric. Div., The Upjohn Co., Kalamazoo, MI). **Chronic toxicity, mutagenicity, and carcinogenicity studies of a new herbicide candidate; U-27267.** *Toxicol. Appl. Pharmacol.* 37(1): 166; 1976.

Studies were initiated to assess the toxicologic, carcinogenic, and mutagenic potential of U-27267 in rodents. Sprague-Dawley rats (40/sex-treatment) and ICR mice (48/sex-treatment) were administered U-27267 as food-drug diet at concentrations of 0, 500, 1500, and 4000 ppm for 24 months and 0, 210, 700, and 2100 ppm for 22 months, respectively. Mutagenicity studies were completed using cytogenic, in vivo host-mediated assay, dominant lethal assay and microbial plate assay with and without liver microsomal enzyme activation. Administration of U-27267 to rats revealed little evidence of overt toxicity. There were significant reductions in body weights ($p < 0.05$) in males and females, an increase in mortality in 4000-ppm females, increases in liver and kidney weights in 1500- and 4000-ppm males and females, and hyperchromic anemia in females at 1500 and 4000 ppm. No carcinogenic response was elicited in rats treated with the compound. Administration of U-27267 to ICR mice revealed significant dose-related hepatotoxicity characterized by hepatomegaly, necrosis, hemorrhage, and hepatocellular degeneration and hepatic nodular hyperplasia in the 700- and 2100-ppm groups. No increase in hepatocellular carcinomas occurred in any of the tested groups. The hepatic nodules were classified as toxic hepatic nodular hyperplasia and not hepatoma because of the morphologic characteristics of the nodules and the inability to transplant the nodules to immunosuppressed recipient ICR mice. All mutagenic studies were also negative. Based on the available data, U-27267 was judged to be hepatotoxic and not to be a carcinogen or a mutagen. (Author abstract by permission, abstract no. 179)

76-2799. Levine, B. S.; Murphy, S. D. (Dep. Physiol., Harvard Sch. Pub. Health, Boston, MA). **Toxic interactions of piperonyl butoxide with dimethyl and diethyl phosphorothionate insecticides in mice.** *Toxicol. Appl. Pharmacol.* 37(1): 166-167; 1976.

Previous experiments have shown that 1 hr after piperonyl butoxide (PB), 400 mg/kg i.p., the acute toxicity of methyl parathion, a dimethyl phosphorothionate (DMP), in mice was reduced by 40×. The same pretreatment increased the toxicity of parathion, a diethyl phosphorothionate (DEP), by 2×. The purpose of this study was to determine if PB interacted similarly with other DMPs and DEPs and to investigate possible mechanism (or mechanisms). As predicted, PB reduced i.p. azinphos-methyl toxicity (3×) and potentiated azinphos-ethyl (6×) in male mice. SKF 525-A pretreatment, 50 mg/kg i.p., 1 hr prior to challenge produced effects on DMP and DEP toxicities that were qualitatively similar to PB. Neither PB nor SKF 525-A appreciably altered the toxicity of the oxygen analogs (oxons). The onset of signs of toxicity of DEPs was delayed by PB although the ultimate LD50 values were reduced. In PB-pretreated mice given 200 mg/kg methyl parathion i.p. (20× the unpretreated LD50), plasma cholinesterase (ChE) steadily declined for 12 hr, suggesting continuing oxon production. Brain ChE, after an initial rapid decrease, remained at the same level for this time period. Liver glutathione fell continuously for 6 hr suggesting a glutathione-dependent demethylation. In vivo metabolism studies showed that PB-pretreatment resulted in three- to seven-fold greater plasma concentrations after challenge with all four insecticides. In vitro metabolism by liver homogenates demonstrated that PB inhibited oxon production and oxidative cleavage to about the same extent for DMPs and DEPs, and that glutathione-linked demethylation of DMPs was occurring. Deethylation was negligible. In vitro reactivation rates of brain and diaphragm ChE were 5-10× faster for DMP oxons compared to their diethyl homologs. These findings suggest that although PB elevation of

plasma concentrations of both DMPs and DEPs provides a potential for greater total oxon formation, a decreased rate of oxon production allows more time for demethylation of DMPs. This plus rapid reactivation of inhibited nerve tissue ChE appears to provide protection against DMP toxicity by PB. In the case of DEPs, inhibition of oxidative detoxification in the absence of an alternative dealkylation pathway, slow reactivation of inhibited nerve tissue ChE, and a potentially greater total oxon formation may account for potentiation by PB. (Author abstract by permission, abstract no. 180)

76-2800. Gallo, M. A.; Knaak, J. B.; Little, D. T.; Maddy, K. T. (Food Drug Res. Lab., East Orange, NJ). **Workers safety reentry study involving phosalone on citrus.** *Toxicol. Appl. Pharmacol.* 37(1): 167; 1976.

This study was designed to determine an interval after applying phosalone at which workers could reenter a California citrus grove without experiencing adverse effects. Fourteen healthy male agricultural workers volunteers, ranging in age from 17-72 years were given complete physicals, including cholinesterase (ChE) determinations, prior to their entry into the phosalone treated grove; four workers treated in like manner served as controls. Blood and urine was sampled at the end of each work day. Two separate sections of a citrus grove were treated with 2× maximum label rate, 12 lb/acre total, so that the workers would enter the respective sections 14-17 days or 21-23 days after the last application. Leaf samples were taken to determine the dislodgeable residue of phosalone and its oxone at Day 0 and daily intervals thereafter. No adverse effects were observed throughout the study and no phosalone or its metabolites were detected in the urine. The RBC ChE was depressed 15% of control, which was slight but statistically significant, on Day 15 but returned to normal by Day 17. There was no RBC ChE depression during Days 21-23 despite the equation amount of dislodgeable residues on the leaves resulting from an earlier application in one section. The plasma ChE remained normal throughout both phases. Since the plasma ChE was normal and no phosalone was detected in the urine, the slight depression in EBC ChE may be indicative of the normal variation of this enzyme system and the small number of controls. To better control any study in the future, the methods used in this experiment should be augmented by an equal number of controls; the schedule should be for 4 straight working days and the urine should be analyzed for alkyl phosphate. (Author abstract by permission, abstract no. 181)

76-2801. Schein, L. G.; Thomas, J. A.; Klase, P.; Edward, W. (Dep. Pharmacol., West Virginia Univ. Med. Cent., Morgantown, WV). **Interaction of carbaryl and dieldrin on the metabolism of [^{3}H]testosterone (^{3}H-T).** *Toxicol. Appl. Pharmacol.* 37(1): 167-168; 1976.

The ability of male reproductive tissues or hepatic microsomes to metabolize androgens was investigated in mature mice treated with carbaryl (32 mg/kg daily × 10, p.o.) and/or dieldrin (1.25, 2.5, or 5.0 mg/kg daily × 10, p.o.). Incubation of prostate glands from pesticide-treated animals failed to reveal any substantial changes in either the nonpolar or polar radiometabolites formed from ^{3}H-T. Hepatic microsomes incubated with ^{3}H-T revealed several changes in the ability of the liver to biotransform labeled androgens. The metabolic profile of hepatic nonpolar radiosteroids (e.g., [H]7α-hydroxytestosterone or [^{3}H]16-α-hydroxytestosterone) was significantly affected by the combined treatment regimens of carbaryl and dieldrin. The formation of tritiated 16α-and 6β-hydroxytestosterone was significantly reduced in most experimental protocols ($p > 0.05$). Conversely, [^{3}H]7α-hydroxytestosterone was significantly increased ($p \zeta 0.05$). These findings reveal that hepatic androgen hydroxylase activities can be altered by pesticides and that the effects observed by a single pesticide administration are not always the same as those responses seen in animals receiving two pesticides. (Author abstract by permission, abstract no. 182)

76-2802. Thomas, J. A.; Schein, L. G. (Dep. Pharmacol., West Virginia Univ. Med. Cent., Morgantown, WV). **Combined effects of parathion and carbaryl on the biotransformation of [^{3}H]testosterone (^{3}H-T) in the male mouse.** *Toxicol. Appl. Pharmacol.* 37(1): 168; 1976.

The interaction of parathion (1.3, 2.6, or 5.2 mg/kg daily × 10, p.o.) and carbaryl (64 mg/kg daily × 10, p.o.) upon androgen metabolism in prostate glands or hepatic microsomes was studied in mature mice. Various dose regimens had essentially no effect upon the conversion of ^{3}H-T to the major radiometabolites in the prostate gland. When hepatic microsomes were incubated with ^{3}H-T, a pesticide interaction was noted as evidenced by significant increases in the formation of [^{3}H]androstanediol ($p < 0.05$). A 5-day regimen of carbaryl (64 mg/kg) followed immediately by another 5-day regimen of parathion (5.2 mg/kg) led to significant increases in the formation of [^{3}H]dihydrotestosterone and [^{3}H]androstenedione ($p < 0.05$). The interaction of these two pesticides caused a consistent elevation in [^{3}H]16α-hydroxytestosterone concentrations in hepatic microsomes thus indicating an enhancement of liver androgen hydroxylase activity. (Author abstract by permission, abstract no. 183)

76-2803. Kinoshita, F. K.; Frawley, J. P.; Keplinger, M. L.; Calandra, J. C. (Ind. Bio-Test Lab. Inc., Northbrook, IL). **Relative cholinesterase and aliesterase inhibition in rat and human blood from exposure to an organic phosphate pesticide.** *Toxicol. Appl. Pharmacol.* 37(1): 168; 1976.

Studies were conducted in which the effects of subacute oral exposure to Torak, *S*-(2-chloro-1-phthalimidoethyl) *O,O*-diethyl phosphorodithioate, on the cholinesterase and aliesterase activities of rats and humans were determined. Weanling female rats were fed dietary levels of 0, 3, 5, 7, 10, 25, 50, or 100 ppm Torak for 1

or 3 weeks. Human volunteers were given Torak as corn oil solutions in gelatin capsules. Single daily doses of 0, 10, 0.03, or 0.1 mg/kg or three divided doses totaling 0, 0.01, 0.02, 0.03, or 0.95 mg/kg/day were taken for various periods of time. Plasma and erythrocyte acetyl cholinesterase, plasma diethylsuccinase, and plasma tributyrinase activities were determined. In the rats, plasma cholinesterase was inhibited at 25 ppm of Torak and higher, plasma diethylsuccinase at 7 ppm and higher, and plasma tributyrinase at 1 ppm and higher. This agrees with other observations that Torak is a mild potentiator of malathion toxicity in rats. In the humans, plasma cholinesterase and tributyrinase were inhibited at 0.05 mg/kg and higher, but diethylsuccinase was not inhibited at any dosages administered. It was also observed that the level of activity of the aliesterases in the human is much lower than in the rat. These observations suggest that the phenomenon of potentiation of malathion toxicity by aliesterase inhibitors frequently observed in rats may be insignificant in humans. (Author abstract by permission, abstract no. 184)

76-2804. Mayer, F. L.; Mehrle, P. M. (Fish Pestic. Res. Lab., Fish Wildlife Serv., Dep. Interior, Columbia, MO). **Vitamin C distribution in channel catfish as affected by toxaphene.** *Toxicol. Appl. Pharmacol.* 37(1): 168-169; 1976.

Vitamin C is essential for development of bone collagen and is also utilized in the liver in detoxification mechanisms through induction of microsomal hydroxylative enzymes. Extensive use of vitamin C in detoxification of organochlorine insecticides such as toxaphene could hypothetically cause a functional deficiency of vitamin C in collagen formation and therefore decrease growth in fish. Toxaphene was the insecticide evaluated since it is extensively used in agricultural areas of the United States, especially on cotton and is frequently found as a contaminant in channel catfish. Channel catfish fry were continuously exposed to toxaphene (38-503 ng/liter) in a flow-through diluter system. The fish were divided into two groups within each concentration and fed a normal diet and a vitamin C deficient diet. After 90 days of exposure, the fish were weighted and measured, backbones were removed to determine collagen concentrations, and vitamin C content was determined on both backbones and livers. Toxaphene significantly ($p < 0.05$) reduced growth and collagen content of backbones. Vitamin C concentrations in liver tissue were not affected by toxaphene, but vitamin C in bone was significantly reduced. The reduction of vitamin C in bone was much more evident in the fish fed the vitamin C deficient diet. Detoxification mechanisms that require vitamin C in the liver do appear to cause a shift of vitamin C from bone to the liver. (Author abstract by permission, abstract no. 185)

76-2805. Yau, E. T.; Mennear, J. H. (Dep. Pharmacol. Toxicol., Purdue Univ., West Lafayette, IN). **The inhibitory effect of DDT in insulin secretion by isolated mouse pancreatic islets.** *Toxicol. Appl. Pharmacol.* 37(1): 169; 1976.

It is known that pretreatment of rats with DDT results in enhancement of gluconeogenesis and glycogenolysis. The mechanism by which DDT affects these aspects of carbohydrate metabolism remains to be elucidated. It is possible that the DDT-induced changes could be mediated through a reduced secretory activity of the endocrine pancreas. The present study was undertaken to determine the effects of orally administered DDT on the responsiveness of isolated pancreatic islets to glucose and tolbutamide stimulation. Eighteen hours after DDT treatment (50 mg/kg, p.o.) pancreatic islets were isolated by the collagenase method. Islets from control mice showed a steady release of insulin when challenged by glucose (3.0 mg/ml). DDT pretreatment reduced insulin secretion to 32% of control values. Similarly, islets from DDT treated mice were significantly less responsive to tolbutamide (0.8 mg/ml), thus showing that the pancreatic inhibitory effect of DDT is not specific for glucose stimulation. Blood glucose concentrations following DDT administration remained unchanged for up to 3 hr. A slight hypoglycemia was noted at the 5- and 7-hr intervals. Blood glucose levels returned to normal at 18 hr after DDT treatment. A study of glucose-stimulated calcium uptake by isolated islets revealed no significant differences between control and DDT islets, indicating that DDT does not inhibit insulin secretion by reducing the permeability of the beta-cell membrane to calcium. Results of the present study indicate that decreased pancreatic secretory activity could account for the DDT-induced changes in carbohydrate metabolizing enzyme systems noted by earlier workers. (Author abstract by permission, abstract no. 186)

76-2806. Koscher, F.; Berndt, W. O. (Dep. Pharmacol. Toxicol., Univ. Mississippi Med. Cent., Jackson, MS). **The nature of the inhibition of renal transport caused by the acute administration of 2,4,5-trichlorophenoxyacetic acid (2,4,5-T).** *Toxicol. Appl. Pharmacol.* 37(1): 169; 1976.

Inhibition of renal organic ion transport caused by administration of 2,4,5-T was demonstrated previously using the renal slice technique. Rats receiving 90 mg/kg 2,4,5-T 24 hr before in vitro analysis of renal tubular function showed a reduced initial uptake and steady-state accumulation of 2,4-dichlorophenoxyacetate (2,4-D) and tetraethylammonium (TEA). Inulin space determinations in renal slices from pretreated and control rats demonstrated that similar extracellular, intracellular, and total tissue water content exist. Likewise, electrolyte composition was unaffected. However, tissue slice respiration from pretreated animals was reduced compared to controls with lactate absent from the incubation medium. Tissue runout studies demonstrate that there is an increase in the efflux rate of 2,4-D and TEA. Additional studies were performed on renal cortical tissue preincubated with 2,4,5-T until a concentration was reached equal to that in the renal tissue of rats pretreated 24 hr before in vitro experiments. These tissues were then incubated with radiolabeled [^{14}C]2,4-D

and uptake was measured. Control tissues preincubated without 2,4,5-T and then incubated with [^{14}C]2,4-D showed the same uptake as the 2,4,5-T preincubated tissue. Alterations in tubular transport may be changes in the tissue oxygen consumption and/or rate of efflux of these organic ions. The decrease in tubular transport is not due to changes in tissue water and electrolyte distribution, or the residual concentration of 2,4,5-T remaining in the tissue after pretreatment. (Author abstract by permission, abstract no. 187)

76-2807. Putnam, J.; Courtney, K. D. (Environ. Protect. Ag., Research Triangle Park, NC). **Metabolic studies with TCDD (dioxin) treated rats.** *Toxicol. Appl. Pharmacol.* 37(1): 170; 1976.

Female Wistar rats treated orally with a single dose (100 μg/kg) of TCDD (2,3,7,8-tetra- chlorodibenzo-*p*-dioxin or dioxin) showed a biphasic decline in body weight with a cessation of food and water consumption and urine production. The first phase started immediately after dosing and lasted 7-10 days followed by a recovery for 4-6 days during which time the rats ate and drank. The rats regained about 10-15% of their body weight. This was followed by a second phase which occurred at 16-24 days after treatment with a weight loss of about 15-30%. The magnitude of the second decline indicated whether or not a rat would survive. If the loss of body weight were greater than about 30%, the rat usually failed to survive. Daily administration of water, electrolyte solution, or a balanced liquid diet did not alter or reverse the biphasic response. Mitochondria from TCDD treated rats were assayed to determine the effects of TCDD on oxidative phosphorylation and ADP:O ratios. (Author abstract by permission, abstract no. 188)

76-2808. Schumann, A. M.; Borzelleca, J. F. (Dep. Pharmacol., Med. Coll. Virginia, Richmond, VA). **The potential methemoglobin and Heinz body inducing capacity of pentachloronitrobenzene (PCNB) in the cat.** *Toxicol. Appl. Pharmacol.* 37(1): 171; 1976.

Pentachloronitrobenzene (PCNB) is currently used in agriculture as a soil and seed treatment fungicide. In view of its aromatic-nitro structure and reduction to pentachloroaniline as one of its metabolites, the methemoglobin generating potential of PCNB, its reversibility by methylene blue, and its ability to produce Heinz bodies were assessed. Adult female cats (four per dose) were orally intubated with PCNB as a 10% solution in corn oil (maximum solubility). Methemoglobin concentrations and Heinz body formation were assessed prior to, and 24, 48, 72, and 168 hr after the administration of PCNB. The percentage of circulating hemoglobin in the form of methemoglobin peaked from a preadministration value of 1.19% to a mean of 1.19% to a mean of 10.99 and 10.15%, 24 and 48 hr, respectively, after 1600 mg/kg of PCNB ($p < 0.05$). Increasing the dose of PCNB to 2400 mg/kg failed to produce higher mean methemoglobin concentrations due probably to the emetic and cathartic effect of the large volume of corn oil administered. In a subsequent experiment, the intravenous administration of methylene blue (2 mg/kg) 40 hr after 1600 mg/kg of PCNB produced a decrease in mean methemoglobin values from 13.93 to 4.24% ($p < 0.05$) in 1 hr. Both 1600 and 2400 mg/kg of PCNB produced a 10-fold increase in the number of circulating erythrocytes containing Heinz bodies. PCNB does not appear to be a potent methemoglobin inducer; that which is produced is reversed by methylene blue. (Author abstract by permission, abstract no. 191)

76-2809. Morris, J. B.; Smith, F. A. (Dep. Radiat. Biol. Biophys., Univ. Rochester Sch. Med. Dent., Rochester, NY). **Biochemical observations on methylene chloride-induced fatty liver.** *Toxicol. Appl. Pharmacol.* 37(1): 172; 1976.

Inhaled methylene chloride is known to produce a fatty liver in the dog, mouse, and guinea pig, but there is little or no data concerning the manner by which this effected. Male guinea pigs were exposed for 6 hr to 5000-6000 ppm of methylene chloride or to room air, in small exposure chambers. The animals were then sacrificed, the liver removed, and sections taken for histological examination; the remainder was subjected to various biochemical measurements. Hepatic triglyceride concentrations were increased about threefold over values in control animals. Phospholipids were increased slightly by the solvent, but not significantly so. Mitochondrial function, as measured by the ability to maintain a positive potassium ion concentration in a K+-depleted medium, and to reaccumulate K+ when K+ was added to the medium, was unimpaired. Uptake of [^{14}C]leucine into total hepatic protein was unaffected. However, glucose-6-phosphatase activity was depressed. These results suggest that since mitochondrial function is normal, β-oxidation of fatty acids is unimpaired. In addition protein synthesis is normal. Therefore, the fatty liver seen might be due to reduced secretion of the lipoprotein complex, or to increased synthesis rates of triglyceride. The latter possibility is under investigation as well as experiments to assess the damage to endoplasmic reticulum suggested by the decreased Glu-6-Pase activity. (Author abstract by permission, abstract no. 193)

76-2810. McCormack, K. M.; Gibson, J. E.; Hook, J. B. (Dep. Pharmacol., Michigan State Univ., East Lansing, MI). **Effect of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) on renal function in rats in vivo.** *Toxicol. Appl. Pharmacol.* 37(1): 177; 1976.

2,3,7,8-Tetrachlorodibenzo-*p*-dioxin (TCDD) has been found to induce proliferation of the smooth endoplasmic reticulum within cells of the pars recta segments of the proximal tubules in rats (Fowler et al., Soc. Toxicol., p. 109, 1975). Since it is generally believed that the pars recta is involved in *p*-aminohippurate (PAH) secretion and sodium ion reabsorption, this experiment was designed to examine the effects of TCDD on these processes in vivo.

Male Sprague-Dawley rats weighing 175-200 g were treated with a single i.p. dose of 0, 25, or 50 μg/kg TCDD in a 10:1 corn oil-acetone solution (25 μg/ml). One week later the rats were anesthetized with pentobarbital Na, 60 mg/kg i.p. Cannulae were placed in the bladder (urine collection) left femoral vein (infusion of fluids), right femoral artery (blood pressure), and left femoral artery (blood samples). Saline containing inulin and PAH was infused i.v. at 1.2 ml/hr. After several control periods plasma volume was expanded (5% body wt) with 1:4 rat plasma:saline, and renal function was monitored for 90 min. Rectal temperature was maintained between 33-38°C with the aid of heat lamp. Rather than stimulation, renal function was depressed as evidenced by a decrease in both inulin and PAH clearance. Fractional Na reabsorption was not affected nor was the response to volume expansion. Thus, these experiments did not identify a renal functional lesion in vivo after TCDD. (Author abstract by permission, abstract no. 205)

76-2811. Hewitt, W. R.; Pegg, D. G.; Hook, J. B. (Dep. Pharmacol., Michigan State Univ., East Lansing, MI). **Effect of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) on renal function in rats in vitro.** *Toxicol. Appl. Pharmacol.* 37(1): 177; 1976.

Acute administration of 2,3,7,8-tetrachlorodibenzo- *p*-dioxin (TCDD) markedly alters renal proximal tubule ultrastructure and enzyme activities. The purpose of this investigation was to examine the effect of TCDD on several in vitro parameters of renal function. TCDD was administered as a single intraperitoneal injection of 10 or 25 μg/kg to adult male Sprague-Dawley rats. Animals were sacrificed 3 or 7 days following treatment. Thin renal slices were incubated in oxygenated media containing *p*-aminohippurate (PAH), *N*-methylnicotinamide (NMN), or 2-deoxyglucose (2-DG) to quantify the effect of TCDD on major renal secretory and reabsorptive transport systems. PAH accumulation was depressed by 25 μg/kg TCDD although treatment with 10 μg/kg had no apparent effect on anion transport. Organic cation transport appeared to be depressed at all doses of TCDD. Pretreatment of rats with either dose of TCDD had no apparent effect on the ability of renal cortical slices to accumulate 2-DG. The effect of TCDD on the ability of the kidney to respond to an acid load was also determined. TCDD (25 μg/kg) had no effect on the ability of cortical slices from nonacidotic rats to synthesize ammonia and glucose with glutamine as substrate. However, TCDD decreased ammoniagenesis and gluconeogenesis by slices from chronically acidotic rats when compared to slices from control animals. In conclusion, the data suggests that TCDD has a relatively nonspecific toxic action depressing several major renal functions. (Author abstract by permission, abstract no. 206)

76-2812. Hanig, J. P.; Yoder, P.; Krop, S. (Food Drug Admin., Washington, DC). **Toxicity and effects upon rat cerebrospinal fluid pressure of hexachlorophene analogs.** *Toxicol. Appl. Pharmacol.* 37(1): 186; 1976.

We have previously reported that toxic effects of hexachlorophene (HCP) include elevation of cerebrospinal fluid pressure (CSFP) in rat and cat, and that this elevation is rapidly lowered with i.v. urea-invert sugar, thereby the profound effect of HCP on the CSFP extended to other members of the same general chemical class. The study was, in fact, broadened to include some more distantly related halogenated aromatic and cycloaliphatic compounds such as bromobenzene, hexachlorobenzene, lindane (hexachlorocyclohexane), chlorpromazine, DDT, and tribromosalicylanilide (TBS) for their effects on CSFP. None of these, with the possible exception of TBS at 200 mg/kg, gave any evidence of effect upon the CSF system, although some did cause certain neurological sequelae suggestive of brain damage of possible edema origin. Closely related structural analogs of HCP of the 2,2-methylenebis chlorophenol class, namely, dichlorophene (DCP), the 4-chlorophenol, and tetrachlorophene (TCP), the 4,6-dichlorophenol isomer, were also investigated. DCP was one-half to one-fifth as acutely toxic as TCP, which in turn was 1/10 as toxic as HCP; neither analog produced elevation of CSFP. Finally, the study extended to various analogs of HCP which are functionally similar in one or several actions, such as uncouplers of oxidative phosphorylation (2,4-dinitrophenol and triethyltin (TET) and producers of myelin-related encephalopathies such as isoniazid, cuprizone, and TET. Of these, only TET (16 mg/kg) produced effects upon CSFP and these were more dramatic than with HCP (lower molar dose; more rapid onset), although qualitatively similar. CSFP as high as 700 mm saline was obtained in some TET-treated rats. There appears to be no correlation between actions eventuating in CSFP changes and degree of chemical similarity to HCP among a wide range of halogenated organic compounds. In contrast, TET, which is structurally unrelated to HCP but functionally analogous, produces similar effects upon CSFP. (Author abstract by permission, abstract no. 224)

76-2813. Winston, F. B.; Wagstaff, D. J.; Hazelwood, J. (Food Drug Admin., Div. Vet. Res., Beltsville, MD). **Pupillary response to dichlorvos in the dog.** *Toxicol. Appl. Pharmacol.* 37(1): 188-189; 1976.

Organophosphate (OP) toxicity traditionally has been measured by observing the blood cholinesterase activity. In an attempt to devise a measurement technique more directly related to clinical poisoning of the central nervous system, the present study was undertaken involving pupillary response. Dark-adapted beagle dogs were placed in a sling with total head restraint and illuminated with an infrared light. Stimulation of the eye utilized an electronic strobe flash and the course of the pupil's contraction and recovery was recorded on infrared film for 3 min. Each dog served as his own control and was filmed at 30 min, 45 min, 1, 1.5, 2, 3, 4, 5, 6, 24, and 48 hr post-treatment. A commercially available worming medicine

containing dichlorvos was administered at 29 mg/kg, the therapeutic dose, to one group of dogs, and 58 mg/kg, double therapeutic dose to a second group. Pupillary response and time required for recovery to prestimulation values increased in both groups with the peak occurring at 45 min to 2 hr and 24 hr in the therapeutic and double therapeutic groups, respectively. Blood cholinesterase and electromyographic studies on these dogs undertaken at the same time showed depressed cholinesterase activity and altered evoked potentials. It is concluded that pupillary response may prove to be a useful method for toxicity testing of organophosphates. (Author abstract by permission, abstract no. 230)

76-2814. Beatty, P. W.; Neal, R. A. (Cent. Environ. Toxicol., Vanderbilt Univ. Sch. Med., Nashville, TN). **Induction of DT-diaphorase activity of rat liver by 2,3,7,8-tetrachlorodibenzo- *p*-dioxin.** *Toxicol. Appl. Pharmacol.* 37(1): 189; 1976.

Of the polychlorinated dibenzo-*p*-dioxins which are contaminants of some preparations of polychlorinated phenols, 2,3,7,8-tetrachlorodibenzo- *p*-dioxin (TCDD) is the most toxic. The LD50 of TCDD in adult male guinea pigs is 0.6 μg/kg. As well as being one of the most toxic synthetic compounds known, TCDD, like 3-methylcholanthrene (3-MC), is an inducer of aryl hydrocarbon hydroxylase (AHH). However, the induction of AHH by TCDD occurs at much lower dosages and is maintained for a much longer period of time than induction by 3-MC. It has been reported recently that rat liver DT-diaphorase undergoes a several-fold increase in activity after in vivo administration of 20 mg/kg 3-MC. In view of the similarities of 3-MC and TCDD as inducers of AHH, it was of interest to examine the possibility of induction of DT-diaphorase activity by TCDD. When TCDD or 3-MC were administered i.p. at dosages of 90 μg/kg or 20 mg/kg, respectively, the rat liver cytosol NADPH-diaphorase activity was increased approximately two- to threefold in animals treated with 3-MC but 16-fold with animals treated with TCDD. These elevated levels of DT-diaphorase activity were maintained for at least 15 days after administration of TCDD. Microsomal NADPH-diaphorase activities from these livers were increased threefold in the 3-MC treated animals and ninefold in those treated with TCDD. As with cytosol, this induction was maintained for at least 15 days postinjection. Induction of rat liver DT-diaphorase by TCDD is quite rapid, exhibiting a twofold increase within 6 hr after administration. (Author abstract by permission, abstract no. 232)

76-2815. Simons, R. S.; Jackett, P. S.; Carroll, M. E. W.; Lowrie, D. B. (Dep. Anaesthetics, M. R. C. Unit Lab., Studies Tuberculosis, Royal Postgrad. Med. Sch., London, England). **Superoxide independence of paraquat toxicity in *Escherichia coli*.** *Toxicol. Appl. Pharmacol.* 37(2): 271-280; 1976. (21 references)

Hyperbaric oxygen failed to enhance the lethal effect of the herbicide paraquat towards *Escherichia coli* B. Variations induced in the intracellular concentrations of either of two endogenous superoxide dismutases had no effect on bacterial susceptibility to paraquat, even in the presence of hyperbaric oxygen. It is concluded that paraquat toxicity is not mediated by superoxide in this organism. (Author abstract by permission)

76-2816. Farber, T. M.; Smith, E. J.; Earl, F. L.; Van Loon, E. J. (Special Pharmacol. Anim. Lab., Div. Toxicol., Food Drug Admin., Washington, DC 20204). **The effect of lindane and phenobarbital on microsomal enzyme induction in dogs and miniature swine.** *Toxicol. Appl. Pharmacol.* 37(2): 319-330; 1976. (34 references)

The enzymic activities of 9000 *g* supernatant fractions obtained from the livers of normal beagle dogs and miniature swine and of dogs and swine treated with lindane and phenobarbital are presented. No significant sex differences in activities were noted in control dogs. Preparations from dogs of both sexes fed lindane at 7.5 and 15.0 mg/kg exhibited a significant loss in codeine demethylase activity while nitroreductase activity was increased twofold. Phenobarbital pretreatment of dogs and swine stimulated all microsomal systems tested. Addition of lindane to the diet of these induced dogs caused a significant and rapid decline in the values after only two feedings. Enzymes induced to a greater extent in dogs by phenobarbital were inhibited to a greater extent by lindane; i.e., as a class, demethylases were affected by both lindane and phenobarbital to a greater extent than aromatic hydroxylases. In contrast, administration of lindane to phenobarbital-treated swine caused an actual further increase in demethylase activities. A decrease in the induced state was observed in aromatic hydroxylation, azo-reduction, and nitro-reduction reactions, although the activities of these enzymes were still higher than the values from control swine. (Author abstract by permission)

76-2817. Moroi, K.; Ushiyama, S.; Satoh, T.; Kuga, T. (Dep. Exp. Pharmacol., Res. Inst. Chemobiodynamics, Chiba Univ., Narashino, Chiba, Japan). **Enzyme induction by repeated administration of tetrachlorvinphos in rats.** *Toxicol. Appl. Pharmacol.* 37(2): 377-386; 1976. (22 references)

The capability of enzyme induction in male rats was studied following the administration of tetrachlorvinphos (TCVP). A single oral dose of either 250 or 1000 mg/kg caused a more marked inhibition of true (erythrocyte) ChE than to pseudo (serum) and brain ChE activities. Dose-related increases in the activities of two hepatic microsomal enzyme activities, aminopyrine demethylase and EPN (*o*-ethyl *O*-*p*-nitrophenyl phenylphosphonothioate) detoxification enzyme, were observed after 10 days of successive administration of TCVP at doses of 60 and 250 mg/kg, p.o. The liver to body weight ratio of rats increased on the first 7 days and then decreased on Day 10. The repeated administration of TCVP induced the enzymes

responsible for the metabolism of TCVP up to 7-fold in microsomes and 1.2-fold in the supernatant fraction. The results demonstrate that the repeated application of TCVP as an insecticides may decrease its toxicity by its capacity to induce metabolizing enzymes. (Author abstract by permission)

76-2818. Tsaregorodtseva, G. N. (Author address not given). **Izucheniye nekotorykh biokhimicheskikh pokazateley v organizme belykh krys pod deystviem khlorofosa, TKhM-3, sevina i dikrezila. [Study of some biochemical indices in albino rats under the effect of chlorophos, TCM-3, sevin, and dicresyl.]** *Tr. Vses. Nauchn. Issled. Inst. Vet. Sanit.* 43: 202-208; 1972. (10 references) (Russian)

Blood cholinesterase and organ and tissue acetylcholinesterase activity was inhibited for 30 days in rats given chlorophos (trichlorfon), TCM-3 (trichlorometaphos-3), sevin (carbaryl), and dicresyl with food in doses of 5, 10, and 50 mg/kg for 65 days. Toward the end of the 65 day period, cholinesterase and acetylcholinesterase activity normalized. Blood sugar levels in rats receiving 50 mg/kg of the 4 pesticides varied within physiological norms for the first month and then increased. Rats receiving 10 mg/kg of the pesticides had a higher blood sugar level than controls. No changes in blood sugar level were noted in rats receiving doses of 5 mg/kg. No disturbances in the protein-forming function of the liver were observed at first. Gamma-globulin function was affected towards the end of the experiment in rats receiving 5 and 10 mg/kg of the pesticides. The use of histochemical methods to study the activity of acid and alkaline phosphatase in organs and tissues was not successful. The administration of the pesticides in the 3 doses for 65 days did not significantly affect the state of the organs and tissues or the body as a whole. Towards the end of the experiment the animals adapted to the pesticides entering their bodies.

76-2819. Safarov, Yu. B.; Aleskerov, Sh. A. (Author address not given). **Deystviye nekotorykh pestitsidov na retsidiv infektsii u perobolevshikh zhivotnykh. [The effect of some pesticides on the recurrence of infection in recovered animals.]** *Tr. Vses. Nauch. Issled. Inst. Vet. Sanit.* 43: 213-218; 1972. (5 references) (Russian)

Sheep which had recovered from paratyphoid fever or infectious mastitis were bathed in a 0.18% solution of arsenious acid, 0.25% emulsion of hexachlorane (BHC), and 1% creolin, or a 1% chlorophos (trichlorfon) solution. Treatment with As decreased the phagocytic activity of blood leukocytes against *Salmonella abortus ovis* and the casautive agent of infectious mastitis and increased blood titers of paratyphoid and staphylococcal agglutinins. Bacteremia and one clinical relapse were observed in 3 of 4 sheep which had recovered from paratyphoid after 6-7 As baths and only bacteremia in 2 of 4 sheep recovered from infectious mastitis after 8-9 As baths. The bactericidal index of blood and the phagocytic index decreased and the paratyphoid agglutinins increased after treatment with hexachlorane-creolin or chlorophos. Three of 5 sheep treated with hexachlorane-creolin developed bacteremia after 7-9 baths but no relapses of infection. One of 5 sheep treated with chlorophos had bacteremia after the tenth bath. The disturbance of the specific and nonspecific protective body functions created a favorable state for bacteremia and relapses. As had the greatest negative effect.

76-2820. Metelev, V. V. (Author address not given). **Gematologicheskiye i biokhimicheskiye issledovaniya pri otsenke toksichnosti pestitsidov dlya ryb. [Hematological and biochemical study in the assessment of the toxicity of pesticides for fish.]** *Tr. Vses. Nauch. Issled. Inst. Vet. Sanit.* 43: 227-232; 1972. (6 references) (Russian)

The effects were studied of methylnitrophos (MNP, fenitrothion, 90%), an emulsion of phosphamide (dimethoate, 38%), trichlorometaphos-3 (TCM-3, 83.6%), sevin (carbaryl 85%), amine salt of 2,4-D (43.7%), sodium fluoride, sodium silicofluoride, and a 30% emulsion of propanide (propanil) on the carp, grass carp, silver carp, and crucian carp. For the organophosphorus compounds and carbamates, acetylcholinesterase activity in blood and tissues was the most sensitive indicator of intoxication; for the fluorides and herbicides, especially the amine salt of 2,4-D, blood sugar levels and liver glycogen level were considered most sensitive. MNP intoxication increased the blood sugar level by 20% and decreased glycogen content in the liver. Similar results were obtained for the phosphamides and TCM-3. The decrease in glycogen reserves in the liver and in hyperglycemia are indicative of intensive consumption of carbohydrates in the intoxicated fish. Disturbance of gas exchange (e.g., hypoxia) was caused by changes in the physical and chemical properties of erythrocytes (propanide, 2,4-D amine salt, MNP) and by the inhibition of enzyme systems (fluorides, sevin). Phosphamide, fluorides, and 2,4-D amine salt inhibited leukopoiesis, and TCM-3, propanide, and sevin inhibited erythropoiesis. All pesticides decreased blood protein levels. Fluorides also had a local effect on the gill epithelium. Changes in lipid metabolism, particularly fat infiltration and degeneration of the liver, were characteristic of the amine salt of 2,4-D. MNP, phosphamide, and TCM-3 decreased blood peroxidase activity by 23-52% and oxygen consumption by 18-41%; this is indicative of the inhibition of redox processes in tissues and of respiratory enzyme activity. Sevin and the amine salt of 2,4-D decreased blood peroxidase activity by 27-43% but increased O_2 use by 26-39%.

76-2821. Nepoklonov, A. A.; Makhno, P. M.; Bukshtynov, V. I.; Zabolotnyy, K. F. (Author address not given). **Izuchenie aktivnosti kholinesterazy krovi, gistologicheskikh i gistokhimicheskikh izmeneniy v organakh i thanyakh ovets pri vvedenii im vnutr' ftalofosa drobnymi dozami. [Study of blood cholinesterase activity and histolog-**

ical and histochemical changes in organs and tissues of sheep injected with fractional doses of phthalophos.] *Tr. Vses. Nauch. Issled. Inst. Vet. Sanit.* 44: 80-83; 1972. (Russian)

The effect of 0.1% aqueous of phthalophos (phosmet) (10 mg/kg for 4 days), used in controlling botfly larvae on sheep, was studied on cerebral, cerebellar, heart, liver, kidney, muscle, and intestinal tissue in sheep. Blood cholinesterase activity decreased by 56.8% 3 days after injection of phthalophos but normalized on the 14th day. Cholinesterase activity in all organs and tissue decreased by 60% by the 6th day but reached normal levels by the 16th day. An increase in the vascularization in the liver and cerebellum and localized desquamation of the small intestinal epithelium were noted after 2 days, but became less apparent after 6 days. No morphological changes were noted in other organs. A decrease in glycogen level was observed in the myocardium, skeletal muscles, and intestinal muscles. The glycogen level normalized by the 16th day. RNA levels in cerebral and cerebellar cells decreased initially. No significant changes in RNA and DNA levels were seen in other organs. Succinate dehydrogenase activity increased in all organs and tissues for the first 6 days but became normal after 10-16 days.

76-2822. Nikolayev, P. I. (Author address not given). **Raspredeleniye khlorofosa i amidofosa v organizme loshadey i vydeleniye etikh soyedineniy s molokom kobyl.** [**Distribution of chlorophos and amidophos in horses and the secretion of those compounds with mare's milk.**] *Tr. Vses. Nauch. Issled. Inst. Vet. Sanit.* 44: 91-98; 1972. (3 references) (Russian)

Chlorophos (trichlorfon) and amidophos (crufomate) were administered per os to mares in doses of 50-100 and 20-40 mg/kg and applied externally in doses of 70-120 and 30-60 mg/kg, respectively. Residues varying from 0.01-10 mg/l were excreted with milk for 17-25 days. Highest pesticide levels in milk were noted in the first 3 to 4 days. After repeated pesticide treatment with the doses given above, significantly lower residue levels were isolated from the milk. Residue levels decreased during the preparation of koumiss from the mare's milk, but residues were not totally degraded. Chlorophos (100 mg/kg) and amidophos (80 mg/kg), administered per os to foals, resulted in residues in all organs and tissues varying from traces to 0.6 mg/kg for chlorophos and from traces to 1.2 mg/kg for amidophos. Traces were isolated for 15 days after a single administration of the pesticides. Trace to 1 mg/kg levels of pesticides were isolated from foal's meat cooked for 2 hours, and 0-0.05 mg/kg was found in the broth.

76-2823. Evdokimov, E. S. (Turkmen Sci. Res. Inst. Anim. Breeding Vet. Sci., USSR). **Vliyanie khlororganicheskikh pestitsidov na organizm zhivotnykh.** [**Effect of organochlorine pesticides on animals.**] *Veterinariya (Moscow)* 12: 94-95; 1974. (Russian)

The toxic effects of DDT and hexachlorane (BHC) were studied in albino rats which recieved 500 mg/kg DDT or 500 mg/kg BHC with 19.2% lindane, or 1,000 mg/kg BHC with 10.4% lindane daily in the food for 20 days. Motor dyscoordination, myasthenia, tremor, paresis of the hind limbs, and weight loss without loss of appetite were observed. Hematological investigations revealed erythropenia, reduction or increase in the leukocyte count, and degeneration of the blood cells (karyopyknosis, karyolysis, and karyorrhexis). Phagocytosis was studied using a virulent strain of *Staphylococcus aureus*. Significant reductions of the phagocytic index beginning on the tenth day and of the phagocyte count were found. These changes indicate impairment of the immune defenses of the organism under the influence of organochlorine pesticides.

76-2824. Shavgulidze, M. M.; Nanobashvili, V. I.; Mirianashvili, M. N. (Georgian Sch. Res. Inst. of Zootech. Vet. Sci., USSR). **O toksichnosti gerbitsida 2,4-D.** [**Toxicity of the herbicide 2,4-D.**] *Veterinariya (Moscow)* 4: 103-104; 1976. (Russian)

The acute and chronic oral toxicities of 2,4-D were studied in sheep. The LD100 of 2,4-D sodium salt was determined to be 900 mg/kg. Sheep that ingested a single dose of 300-400 mg/kg showed no clinical symptoms of poisoning. Asthenia, depression, ataxia, hypothermia, dyspnea, paralysis of the muscles, loss of appetite, and intense reaction to light were observed in animals to which a dose of 500-1,000 mg/kg was administered. The animals died in 2-4 days. Predominantly transient hematological and biochemical changes were observed in sheep which received a daily dose of 18 mg/kg for 120 days. The 2,4-D administered in a single dose of 300-400 mg/kg was detoxified in 9-12 days. The findings indicate that animals treated with 2,4-D internally can be released for slaughtering for human consumption no earlier than 12 days after treatment.

76-2825. Khaitov, R. Kh.; Shevchenko, N. Kh.; Baymuradov, T. B.; Khaitov, V. R. (Uzbek Sci. Res. Inst. Vet. Sci., USSR). **Sanitarno-toksikologicheskaya otsenka produktov uboya zhivotnykh pri otravlenii antio.** [**Sanitary-toxicological appraisal of products from cattle poisoned by anthio.**] *Veterinariya (Moscow)* 3: 105-107; 1976. (Russian)

The changes in the residue levels of anthio (formothion) and of phosphamide (dimethoate), its metabolite, were studied in different organs of sheep following oral poisoning with a single 45 mg/kg dose (1/4 LD50) of anthio. The meat of the animals killed a few days after poisoning had the specific odor of anthio. The biochemical properties of such meat were different from those of normal meat. Both the organoleptic and biochemical properties normalized in 7 days. Residue analysis in different organs revealed no residues of anthio from the second day onward. In animals killed 2 days after poisoning, the phosphamide levels in the liver, heart, lungs, brain, kidneys,

and muscles were 2.5, 0.8, 0.5, 0.15, and 0.6 mg/kg, respectively. Traces of phosphamide were found in animals killed after 14 days, and the residue level was highest in the liver with 0.1 mg/kg. The liver was the only organ to contain traces of phosphamide 17 days after poisoning. Considerable inhibition of acetylcholinesterase activity was observed in chicks and rats fed 50 g/kg of meat from sheep killed during the first 10 days after poisoning. The findings indicate complete elimination of anthio and its metabolite from sheep in 20 days.

76-2826. Matveyeva, S. A.; Barsel', V. A.; Yevseyenko, L. S. (Inst. Chem. Physics, Moscow, USSR). **Izmeneniye ekskretsii nadpochechnikovykh steroidov v zavisimosti ot kontsentratsii khloditana (2,4'-DDD) v krovi onkologicheskikh bol'nykh. [Change in adrenal steroid excretion depending on the chlodithane (2,4'-DDD) concentration in the blood of oncology patients.]** *Vop. Onkol.* 22(4): 35-41; 1976. (17 references) (Russian)

Gas-liquid chromtographic analysis of the blood level of chlodithane (*o,p'*-DDD, TDE) in cancer (renal adenocarcinoma, breast and prostate carcinoma) patients indicated that it rose sharply during the first 2 hr after a single dose of 2.0 g, then slowly decreased up to the fourth hour, followed by a more rapid decrease. During this time, minimal quantities of chlodithane and its metabolites were excreted with the urine, indicating that most of the preparation had been transferred to the fat depot. During the first week of long-term treatment (4 g/day), a rapid increase in the background blood level of chlodithane to a mean level of 6.5 mg/l was observed, after which it reached a constant level of 7.3-8.1 mg/l for 1.5-2.0 mo. Evidently an equilibrium was achieved between the entrance of chlodithane into the blood from the intestine and the fat depot and processes of metabolism and excretion. Upon cessation of treatment, the blood of chlodithane was decreased by 50% after an average of 14 days, with traces remaining in the blood of some patients as long as 2-3 mo. During the first weeks of a 7-week treatment with daily doses of 4-8 g, 17-hydroxycorticosteroid (17-OCS) excretion decreased by 2-2.5 times, while that of 17-ketosteroids (17-KS) decreased more gradually and less significantly (by 1.5-2 times). After cessation of treatment steriod excretion remained constant for 4 wk in most patients. In two patients with breast and renal cancer observed for 7 and 9 wk after the conclusion of treatment, 17-OCS excrection was 4.9 and 5.2 mg/day (as compared to 1.7 and 1.74 mg/day at the close of treatment), while 17-KS excretion was 6.9 and 4.6 mg/day (as opposed to 5.8 and 3.1 mg/day immediately after treatment ended). Thus 17-OCS excretion was reduced to a greater extent and for a longer period than 17-KS excretion. The use of chlodithane (in four equal doses every 4 hr with an 8-hr interval at night for 1-1.5 mo with a subsequent 3-4-wk break) is recommended in the complex treatment of hormone-dependent tumors for purposes of drug adrenalectomy.

76-2827. Olefir, A. I. (Kiev. Sci. Res. Inst. Ind. Hyg. Occup. Dis., Kiev, USSR). **Izucheniye dlitel'nosti posledeystviya ostrykh i khronicheskikh intoksikatsiy khimicheskimi veshchestvami. [Study of the duration of the aftereffect of acute and chronic intoxications with chemical substances.]** *Vrach. Delo* 2: 105-109; 1976. (22 references) (Russian)

The duration of the aftereffects of derivatives of carbamic (carbaryl, barban, dicresyl), thiocarbamic (molinate, pebulate, EPTC), and dithiocarbamic (maneb, thiram, polymarcin) and of organophosphorus (trichlorfon, malathion, methyl parathion), organochlorine (DDT, strobane), and dinitrophenol (dinocap) compounds was studied in rats one and two months after single injections of maximum tolerable doses or repeated injections for 4.5 mon of doses of 1/20 LD50 (1/50 LD50 for TMTD and DDT). One month after single injections of the organochlorine compounds and dinocap and two months after single injections of the carbamates, thiocarbamates, maneb, and polymarcin, the natural resistance of the body was restored. Nonspecific immunity was disturbed throughout the two months following single injections of thiram and the organophosphorus compounds. After chronic intoxication with carbaryl, molinate, polymarcin, and methyl parathion, the level of nonspecific immunity approached that of the control animals after a month. Inhibition of natural resistance was maintained over the course of two months after chronic intoxication with barbon, dicresyl, EPTC, pebulate, maneb, thiram, trichlorfon, and DDT. In order to evaluate the duration of the period required for restoration of immunity, analysis of the neutrophilic digestive capacity and serum levels of lysozyme and beta-lysin is recommended in the case of acute intoxications, and analysis of neutrophilic digestive capacity, serum levels of beta-lysin and complement, and the *Escherichia coli* count on the oral mucosa is recommended in the case of chronic intoxications.

76-2828. Badayeva, L. N.; Kiseleva, N. I. (All-Union Sci.-Res. Inst. Hyg. Toxicol. Pestic., Polymers, and Plastics, Kiev, USSR). **Morfologicheskiye izmeneniya nervnykh struktur v organizme materi i ploda pri vozdeystvii polikhlorkamfena. [Morphological changes in nervous structures in the body of mother and fetus during exposure to polychlorocamphene.]** *Vrach. Delo* 2: 109-113; 1976. (Russian)

Daily feeding rats with 12 mg/kg (1/20 LD50) polychlorocamphene (PCC, toxaphene) the first 14 days of pregnancy resulted in accumulation in heart (2.5 μg/g), uterus (1.9 μg/g), and brain and spinal cord (1.2 μg/g). These low PCC levels in the brain and spinal cord were accompanied by significant morphological changes and enzymatic restructuring of cholinesterase activity, indicating the high PCC sensitivity of nervous (cholinergic) structures. Daily injection of PCC for the first 20 days of pregnancy increased the PCC levels to 17 μg/g in the heart, 9.7 μg/g in the uterus, and 4.3 μg/g in the brain and spinal cord. The degree of structural and enzymatic changes in

the nervous elements of the organs studied also increased. Trophic disturbances were reflected by reduced transketolase activity, redistribution of cholinesterase activity in nervous apparatus, and changes in the functional activity of cholinergic structures. Cholinesterase activity redistribution also pointed to changes in membrane permeability to Na, K, and Cl ions. Foci of muscle fiber destruction were observed in the heart. The PCC level was greater in the fetal organs (2.9 μg/g) than in the placenta (2.3 μg/g), which, together with morphological changes observed in the uterus and placenta, provided evidence of the passage of the pesticide across the placenta in connection with changes in its permeability. Postimplantation death, stillbirth, decreases in birth weight, and disturbances in nervous system embryogenesis indicated a direct toxic effect of PCC on the various fetal systems, including the nervous system.

76-2829. Adelman, I. R.; Smith, L. L., Jr.; Siesennop, G. D. (Dep. Entomol., Fish. Wildl. Univ. Minnesota, St. Paul, MN 55108). **Effect of size or age of goldfish and fathead minnows on use of pentachlorophenol as a reference toxicant.** *Water Res.* 10(8): 685-687; 1976. (11 references)

The difference in sensitivity to PCP of different sized fathead minnows and goldfish of a constant age or stock was determined, as was the difference in sensitivity of different aged fathead minnows. The rate of mortality during the test was similar when using different sized goldfish, but the threshold LC50 was higher for small fish. The rate of mortality during the test was significantly different when using different sized fathead minnows, but the threshold LC50 was the same for large and small fish. The rate of mortality was different using different aged fathead minnows, the rate being the same for 11-, 7-, and 4-week-old fish, but different for 14-week-old fish. There was no difference in threshold LC50 due to age. Size selection of fatheads or goldfish within the ranges tested is unnecessary since differences are small. Since age of fatheads did not affect the 24 hr, 96 hr, or threshold LC50s, use of younger fish would allow smaller bioassay chambers or more fish per chamber.

See also 76-2628 76-2637 76-2642 76-2645 76-2646 76-2668 76-2670 76-2675 76-2864 76-2870

76-2830. Fitzek, A. (Dep. Pharmacol. Toxicol., Sch. Vet. Med., Free Univ., Berlin, Germany). **Polarographic determination of thallium in urine.** *Acta Pharmacol. Toxicol.* 36(2): 187-189; 1975. (6 references)

A method is presented for the determination of thallium in animal urine. The method is very simple and satisfactory in terms of specificity, sensitivity, and reproducibility. Samples of 2-5 ml urine are diluted with bidistilled water and poured onto a column containing 0.5 g of the cation exchanger CM-SEPHADEX-C-25. The exchanger is washed with bidistilled water and the thallium is reexchanged with 20 ml of a 5% diaminoethane-dinitrate solution at pH 5.0. The solution is introduced into an electrolysis cell, deaerated (N_2), electrolyzed for 4 min at 01.0 V vs. a standard calomel electrode, and after an interval of 2 min is scanned anodically from -0.7 V to -0.2 V. Thallium has a peak potential at -0.42 V. The height is proportional to its concentration in the solution. For standardization, a solution of Tl_2SO_4 (5 μg Tl+/20 μl) is added.

76-2831. Bonelli, E. J.; Taylor, P. A.; Moriss, W. J. (Author address not given). **Mass fragmentography GC/MS in the analysis of hazardous environmental chemicals.** *Am. Lab.* 7(7): 29-30,32-35; 1975. (5 references)

The application of gas chromatography/mass spectrometry (GC/MS) to environmental pollution has solved problems relating to both sensitivity and identification. When operated in the normal scanning mode a GC/MS provides structural information and sensitivity equivalent to a standard flame ionization detector. When operated in the mass fragmentography mode, a GC/MS provides specific information at a sensitivity level which often surpasses that of the electron capture detector. The mass fragmentography mode of operation can be illustrated in the analysis of pesticides. Generally the base peak and molecular ion are the most characteristic ions, and these are the ones normally monitored. The ion fragments monitored should also be the most intense and interference-free. The practical application of this technique is demonstrated by the partial mass spectra of DDT and its metabolites, and the ions monitored are summarized. A computer-generated mass fragmentogram of a whole fish extract is also shown which allows the unambiguous identification and quantitation of 5 pesticides in one injection.

76-2832. Grubic, Z.; Kiauta, T.; Brzin, M. (Inst. Pathophysiol., Univ. Ljubljana, 61105 Ljubljana, Yugoslavia). **A radiometric method for the determination of choline acetylase activity based on thin-layer chromatography.** *Anal. Biochem.* 74(2): 354-358; 1976. (12 references)

A rapid thin-layer chromatographic method on Gelman ITLC type SA plates has been developed for the determination of choline acetylase activity. The mobile phase consists of sodium tetraphenylboron dissolved in acetonitrile. The *Rf* values for acetyl coenzyme A and acetate are about 0.1, while that for acetylcholine is about 0.9. The recovery of the reaction product is quantitative, and its separation from other labeled compounds of the incubation medium is total. The sensitivity is limited only by the specific activity of the labeled substrate. Reproducibility is good. Forty samples can be conveniently analyzed in 40 min. The enzyme reaction is stopped by cooling the samples to 0°C. The method is potentially adaptable for differential assay of ChAc. The method compares favorably with, and may also be a useful alternative to, other radiometric methods for ChAc assay.

76-2833. Buser, H. R. (Swiss Federal Res. Stn. Arboricult, Viticult. Horticult., CH-8820 Waedenswil, Switzerland). **High-resolution gas chromatography of polychlorinated dibenzo-*p*-dioxins and dibenzofurans.** *Anal. Chem.* 48(11): 1553-1557; 1976. (15 references)

High-resolution gas chromatography was applied to the analysis of polychlorinated dibenzo-*p*-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs). Glass capillary columns with stationary phases of different polarity were used to study the separation of these hazardous compounds occurring in commercial pentachlorophenol samples. Thin-film, narrow bore glass capillary columns (22 m × 0.3 mm i.d.) allowed lower operating temperatures (205-225°C) and showed greatly increased separation efficiencies compared to conventional packed columns. Electron capture detection was employed. Sample introduction was effected by an isothermal splitless injection technique with a high-boiling solvent. Mass spectrometric analyses allowed peak identifications. This system was applicable for trace analyses. The technique may offer an alternative to conventional gas chromatography with highly specific detection techniques.

76-2834. Gomez-Taylor, M. M.; Kuehl, D.; Griffiths, P. R. (Dep. Chem., Ohio Univ., Athens, OH 45701). **Vibrational spectrometry of pesticides and related materials on thin layer chromatography adsorbents.** *Appl. Spectrosc.* 30(4): 447-452; 1976. (11 references)

Two methods for direct measurement of the vibrational spectrum of chemical species on TLC plates were studied, one of which involves the use of an infrared Fourier transform (FT-ir) spectrometer, and the other of which utilizes Raman spectrometry. Scattering of the adsorbent has been minimized in these experiments by treating the TLC plate with Fluorolube, an infrared mulling oil with a refractive index close to that of the adsorbent. When measured in this way, spectra of chlorinated hydrocarbon pesticides on silica gel and alumina adsorbents showed differences which can be correlated with the mechanism of adsorption. FT-ir spectra of compounds on TLC plates can be obtained from microgram quantities of samples. However, Raman spectrometry is not as sensitive. At least 200 μg of sample are required. Raman bands of adsorbed pesticides were weak and considerably broadened with respect to the corresponding bands in the spectra of the pure samples.

76-2835. Pordab, Z.; Maik, L. (Inst. Food Technol., Poznan, Poland). **Badania nad oznaczanisw DDT i jego metabolitow (DDE, DDE), lindanu i DMDT w surowcach miesnych, stosowanych do produkcji konserw dla dzieci craz w produkcie gotowym, przy zastosowaniu metody chromatografii cienkowarstwowej.** [**Studies on the estimation of residues of DDT and its metabolites (DDE, DDD), lindane, and DMDT, in meat for baby foods production and in baby foods, using the method of thin layer chromatography.**] *Biul. Inst. Ochr. Rosl.* 54: 521-533; 1972. (3 references) (Polish)

Meat, liver, and baby foods were analyzed for residues of DDT and its metabolites, lindane, and DMDT (methoxychlor). Methods were studied for purifying petroleum ether extracts of the samples. Chlorinated hydrocarbon determinations were performed by thin layer chromatography. The best clean-up method for meat and baby food extracts was the two-step procedure using acetonitrile partitioning and the alumina column. The possibility of replacing acetonitrile with DMF (dimethyl formamide) in the case of meat and liver sample purification is considered. The sensitivity of the method employed permitted detection of DDT, DDE, DDD, and DMDT residues at the 0.02 ppm level for baby foods and liver, at the 0.01 ppm level for meat, and permitted the detection of lindane at the 0.4 and 0.2 ppm levels, respectively.

76-2836. Pordab, Z.; Maik, L. (Inst. Food Technol., Poznan, Poland). **Badania nad oznaczaniem DDT i jego matabolitow (DDE, DDD), lindanu i DMDT w surowcach warzywnych stosowanych do produkcji konserw dla dzieci, przy zastosowaniu metody chromatografii cienkowarstwowej.** [**Studies on the estimation of residues of DDT and its metabolites (DDE, DDD), lindane and DMDT in vegetable raw materials for baby foods production, using the method of thin layer chromatography.**] *Biul. Inst. Ochr. Rosl.* 54: 535-551; 1972. (14 references) (Polish)

Determinations were made of DDT and its metabolites, lindane, and DMDT (methoxychlor), in vegetables using petroleum ether for extraction of the chlorinated hydrocarbons. After studying various widely used methods of purifying petroleum ether extracts, an optimal method for each vegetable was selected. The extracted materials were purified in seven ways and then analyzed using thin layer chromatography. The florisil column proved to offer the best cleanup for vegetables; for carrot the florisil column with previous acetonitrile partitioning was best. Cleanup using sulfuric acid could be applied to all vegetable extracts, but its efficiency was not as good as that of the florisil column. Vegetables were found to have pesticide residues in the ranges of 0.00-0.2 ppm. The detection limit of the chosen method was 0.002 ppm for DDT and its metabolites and DMDT and 0.04 ppm for lindane.

76-2837. Mes, J.; Campbell, D. S. (Dep. Natl. Health Welfare, Health Protect. Br., Food Directorate, Tunney's Pasture, Ottawa, Ontario, Canada). **Extraction efficiency of polychlorinated biphenyl, organochlorine pesticides and phthalate esters from human adipose tissue.** *Bull. Environ. Contam. Toxicol.* 16(1): 53-60; 1976. (11 references)

Adipose tissue from human accident victims was extracted using various techniques and analyzed for PCB, organochlorine pesticides, and phthalate esters using electron capture gas chromatography. Extraction using the Silverson Mixer was slightly superior overall to that achieved using the Waring Blender and Virtis Model 23. The amount of residue obtained was not necessarily related to the amount of lipid extracted. Of the solvents tested, benzene plus acetone (1:19 v/v) provided the best extraction of PCB, HCB, *p,p'*-DDE, and DBP the worst extraction of DEHP; it was not the best solvent for total lipid extraction. All solvents tested can be used for the extraction of PCB, organochlorine pesticides, DBP, and DEHP from human adipose tissue.

76-2838. Musial, C. J.; Peach, M. E.; Stiles, D. A. (Acadia Univ., Wolfville, Nova Scotia, Canada). **A simple procedure for the confirmation of residues of α- and β-endosulfan, dieldrin, endrin, and heptachlor epoxide.** *Bull. Environ. Contam. Toxicol.* 16(1): 98-100; 1976. (7 references)

A simple modification of the Hamence procedure can be used to identify α- and β-endosulfan, dieldrin, endrin, and heptachlor epoxide. An extract containing insecticide is mixed with hydrochloric acid-acetic anhydride reagent, heated, cooled, and further mixed with distilled water and saturated sodium carbonate solution. Hexane is added to the solution, and the layers are allowed to separate. The organic layer is analyzed by electron capture gas chromatography using a 0.91 m × 0.73 cm Pyrex glass column packed with 10% OV-1 on GHP 80-100 mesh. All the compounds within a given fraction can be resolved, and there is no detectable blank from the reagent. The limit of detection in soil is in the range of 0.5-1.0 ppb.

76-2839. Cochrane, W. P.; Greenhalgh, R. (Lab. Services Sect., Plant Products Division, Agric. Canada, Ottawa, Ontario, Canada). **Evaluation and comparison of selective gas chromatographic detectors for the analysis of pesticide residues.** *Chromatographia* 9(6): 255-265; 1976. (35 references)

Studies conducted on the evaluation and comparison of selective gas chromatographic detectors for pesticide residue analysis are described. The study included analyses of the optimization and response characteristics of the CsBr and RbCl three-electrode alkali flame ionization detector for N and P compounds; the Coulson electrolytic conductivity detector in the nitrogen, sulfur, and pyrolytic modes of operation; and the sulfur phosphorus emission detector, a type of flame photometric detector. The alkali flame and electrolytic conductivity detector responses to nitrogen compounds were of the same order, while the electrolytic conductivity detector was more sensitive than the flame photometric detector to sulfur com-

pounds. It is recommended that chlorpyrifos be used as an evaluation standard in verifying the acceptable performance of these types of detectors.

76-2840. Stadler, D.; Ziebarth, U.* (Deutsches Hydrographisches Institut, 2 Hamburg 4, Germany). **Beschreibung einer Methode zur Bestimmung von Dieldrin, *p,p'*-DDT und PCB's in Seewasser und Werte fuer die Deutsche Bucht, 1974. [Description of a method for the determination of dieldrin, *p,p'*-DDT, and PCBs in seawater and data for the German Bight, 1974.]** *Dtsch. Hydrograph. Z.* 6: 263-273; 1975. (18 references) (German)

In May of 1974 measurements of insecticide pollution in the German Bight were made. Ten-liter water samples were taken at each of 22 stations by a stainless steel bucket lowered from the bow of the vessel which was proceeding at slow speed against the surface current. The samples were dried, concentrated, and subjected to thin layer chromatography, separate elution of three thin layer chromatography zones, and gas chromatography on two columns of different polarity. Mean values and standard deviations for all stations were, in ng/kg; dieldrin: 0.3 (0.1); *p,p'*-DDT: 0.3 (0.2); and PCB: 3.1 (0.9). Detection limits for the overall method are about 0.05 × ng/kg/individual substance. Standard deviations obtained from laboratory experiments for the determining of recovery rates (related to an input quantity of 100%) are: dieldrin 30%, *p,p'*-DDT 40%, and PCB 30%.

76-2841. Pristavko, V. P.; Degtyarev, B. G.; Chayka, V. N. (Ukranian Sci. Res. Inst. Plant Protect., Kiev, USSR). **Elektrifiziologicheskaya reaktsiya obonyaniya yablonnoy plodozhorki *Laspeyresia pomonella* L. kak vozmozhnyy ekspress-metod opredeleniya toksichosti i soderzhaniya insektitsidov. [Olfactory electrophysiological reactions of the apple fruit moth *Laspeyresia pomonella* L. as a possible rapid method for determining the toxicity and levels of insecticides.]** *Dokl. Akad. Nauk SSSR* 228(4): 999-1000; 1976. (11 references) (Russian)

The biopotentials generated in the antennae of 1-2-day-old *Laspeyresia pomonella* images by different concentrations of three insecticides with highly different LD50 values (phosalone, malathion, and tetrachlorinphos) were studied. The possibility using this electrophysiological method was considered for rapid determination of the toxicity and concentrations of insecticides in air, water, and fruits. The insects responded with increased amplitudes of antenna potential to even low concentrations of the insecticides in air, water, and apple puree. They responded to 0.0001 mg/kg of phosalone, 0.001 mg/kg of malathion and 0.1 mg/kg of tetrachlorvinphos in water, while the order thresholds must have been lower. The findings indicate high sensitivity of insects to the odor of pesticides, and provide a theoretical possibility of utilizing this phenomenon for the rapid and accurate determination of insecticide residues in crops and in the environment.

76-2842. Marozzi, E.; Gambaro, V.; Lodi, F.; Pariali, A. (Ist. Med. Leg., Univ. Milan, Milan, Italy). **La ricerca chimico-tossicologica sistematica generica in tossicologia forense. 1. Considerazioni sulle metodiche di saggio gaschromatografico da applicare nella ricerca chemicotossicologica generica. [Systematic chemical-toxicological research in forensic toxicology. 1. Considerations on gaschromatographic method as applied to chemical-toxicological research.]** *Farmaco Ed. Prat.* 31(4): 180-211; 1976. (23 references) (Italian)

Retention indices for 230 substances of toxicological interest were determined on SE_{30}, OV_1, and OV_{17}. Similar determinations were made for 60 substances on QF_1 in isothermal conditions at 180°. Comparisons between SE_{30} and OV_1 and comparisons with the findings obtained by Kazjak and Permisohn showed essentially no significant deviations in the series, except for the data on QF_1 where the method used to calculate the retention index was known not to guarantee correct results. The data for gas chromatographic mobility was reproducible to a great extent, even when assays were conducted in different sites. Thus, mobility, expressed as IR, is of great diagnostic value. By using the IR value in general gas chromatography, chemical-toxicological investigations can be can be rapidly restricted to a very limited number of substances during a specific investigation.

76-2843. Luzhkov, A. D. (Dep. Pharmacol. and Toxicol., Leningrad Inst. Vet. Sci., Leningrad, USSR). **Ispol'zovanie vozbuzhdennoy lyuminestsentsii pri opredelenii DDT i geksakhlorane khromatografiey v tonkom sloe s flyuorestseinom. [Use of stimulated luminescence for determination of DDT and hexachlorane by thin-layer** chromatography with fluorescein.] *Gig. Sanit.* 40(5): 70; 1975. (1 reference) (Russian)

An improved version of a thin-layer chromatographic method for the determination of DDT and hexachlorane (BHC) with florescein and UV irradiation is described. The original method, elaborated by G. I. Uporova and S. Yu. Shtyler, has the disadvantage of giving chromatograms of inadequate sharpness and distinction. According to the modified version, the plates are dried in air and irradiated with UV light until the appearance of violet spots (20-30 min), after which visible light is filtered out, and the plate is irradiated at a wavelength of 360 nm. Due to the stimulated luminescence, the dark violet spots with sharp contours will be luminescing intensely.

76-2844. Popova, N. G.; Khasanov, Yu. U.; Muzykantova T. B. (Uzbek Sci. Res. Inst. of Sanit. Hyg. and Occup. Dis., Tashkent, USSR). **Opredelenie antio i butifosa v vode metodom khromatografii v tonkom sloe. [Determination of anthio and butiphos in water by thin-layer chromatography.]** *Gig. Sanit.* 40(6): 50-51; 1975. (Russian)

A thin-layer chromatographic method for the quantitative determination and identification of anthio (for-

mothion) and butiphos (DEF) in water is described. Following extraction with chloroform or diethyl ether, the extract is concentrated and applied on KSK or ShSK silicagel layer, using bromophenol blue in a solution of silver nitrate in water-acetone mixture. The plates are then dried at 50°C for 20 minutes, after which they are sprayed with 2% citric or acetic acid solution. Anthio and butiphos appear in the form of bluish violet spots against a yellow background. The sensitivity amounts to 1 μg, corresponding to 0.005 mg/liter.

76-2845. Gzhegotskiy, M. I.; Shklyaruk, L. V.; Mynka, A. F. (Lvov Med. Inst., Lvov, USSR). **Ekspress-metod indikatsii pestitsida benleita.** [**A rapid method for detection of the pesticide benlate.**] *Gig. Sanit.* 41(4): 69-70; 1976. (Russian)

A rapid method for benlate (benomyl) detection is based on the production of a color reaction during the interaction of the studied substance with chemically pure pyridine, chlorine water, and a 50% aqueous solution of potassium hydroxide. In the presence of benlate and depending on its concentration, the liquid acquires a rich brown to light brown color. For quantitative determination of benlate, the colored solution is subjected to colorimetric analysis, using the method of standard series. The sensitivity of the method is 0.005 mg/ml, which, since benlate has a low toxicity, may be considered satisfactory. This method for detecting benlate in water or in a commercial preparation is specific, highly sensitive, simple, reproducible, and fast, requiring no more than 5 min. The method is recommended for public health and agricultural application.

76-2846. Chmil', V. D. (All-Union Sci.-Res. Inst. Hyg. Toxicol. Pestic., Polymers, and Plastics, Kiev, USSR). **Opredeleniye ostatochnykh kolichestv gerbitsidov-proizvodnykh fenoksial-kankarbonovykh kislot (2,4-D, 2M-4Kh, i 2,4-DM) v vode khromatograficheskimi metodami.** [**Chromatographic determination of residues of herbicides which are phenoxyalkanoic acid derivatives (2,4-D, MCPA, and 2,4-DB) in water.**] *Gig. Sanit.* 41(4): 66-69; 1976. (5 references) (Russian)

Chromatographic analysis of the methyl esters of the phenoxyalkanoate herbicides, using dimethylsulfate as a methylating agent, was conducted on the Soviet gas chromatograph "Tsvet-106" with an electron capture detector. Additonal halogen atoms were introduced into the MCPA molecule to increase its electron affinity. 2,4,5-Trichlorophenoxyacetic acid (2,4,5-T) was selected as an internal standard for the gas-liquid chromatographic determination of 2,4-D and 2,4-DB in water. The percentage of added 2,4-D determined was 99.5 ± 3.7, while that of 2,4-DB was 99.6 ± 4.3, and the sensitivity of the determination was 0.005 mg/l. The minimum detectable quantity of the methyl esters was 2 ng for 2,4-D and 4 ng for 2,4-DB, while the linear dynamic range of detection was not less than 70 ng. The analysis took 2 hr. A combination of gas-liquid and thin layer chromatography was used to increase the reliability of 2,4-D and 2,4-DB determination, particularly in the analysis of samples for which the circumstances of pollution were unknown. The method of absolute calibration was used in the gas-liquid chromatographic determination of MCPA in water. The percentage of added MCPA determined was 84.5 ± 8.4, the minimum detectable quantity was 1 ng, the sensitivity of the method was 0.003 mg/l, and the time required was 27 hr. In tests with 2,4-D and 2,4-DB, the use of absolute retardation factors in the identification of peaks on the chromatogram was found to be a source of error.

76-2847. Becsey, T. (Csongrad County Council Pharmacol. Cent., 6710 Szeged, Hungary). **Gyers kromatografias modszer foszforsaveszter-peszticidek felkvantitativ meghatarozasara verbol.** [**Rapid semiquantitative chromatographic method for the determination of phosphoric acid ester insecticides in blood.**] *Gyogyszereszet* 18(2): 50-52; 1974. (4 references) (Hungarian)

A rapid semiquantitative thin-layer chromatographic method for the determination of organophosphorus pesticide residues in blood is described. Following extraction with a mixture of petroleum ether and ethyl ether containing sodium chloride, cleanup is done on a silica gel-packed chromatographic column. Methyl and ethyl dithioates are eluted with benzene, while benzene with ethyl acetate is used for the elution of methyl and ethyl phosphorothioates, and, in a next step, for the elution of ethyl and methyl phosphates. Thin-layer chromatographic identification is done on a polyamide layer, using acetonitrile as a solvent and 4-nitrobenzylpyridine with acetone as developer. The lower limits of detectablility are 0.1 μg for methyl and ethyl parathion, 0.05 μg for sumithion (fenitrothion), 0.5-1 μg for dimethoate and trichlorfon, and 15-20 μg for DDVP (dichlorvos). The rapid method is also suitable for the determination of metabolites the applicable to the testing of foods and tissues for organophosphoric ester pesticide residues.

76-2848. Gilbert, D. D.; Mann, J. M. (Chem. Dep., Northern Arizona Univ., Flagstaff, AZ 86001). **Herbicide analysis by pulse polarography—picloram.** *Int. J. Environ. Anal. Chem.* 2(3): 221-228; 1973. (19 references)

A study was undertaken to optimize the analysis of picloram by pulse polarography to yield reproducible, rapid, and relatively sensitive determinations. The method described for determining picloram in water is 4-5 times more sensitive than other reported polarographic methods and is more rapid than the conventional bioassay or gas chromatographic techniques. Also, the pulse method is about 10 times more sensitive than the colorimetric analysis and can be conducted in a normally lighted lab. As little as 0.02 ppm picloram can be detected by pulse polarography. Possible interference from metal ions must be considered. The analysis can be applied to a variety of other herbicides, including paraquat, diquat, and barban.

76-2849. Sherma, J.; Marzoni, G. (Lafayette Coll., Eas-

ton, PA 18042). **Detection and quantitation of anilines by TLC using fluorescamine reagent.** *Int. Lab.* 41-42,46,68-50,52; 1974. (44 references)

The detection of aniline and a series of ten substituted derivatives is reported on thin layer chromatograms by spraying with fluorescamine reagent, followed by densitometric quantitation by in situ scanning of the resulting fluorescent spots. The particular anilines chosen for study are related to important amide, carbamate, and urea pesticides; they may be formed as residues by degradation or metabolic processes, and are therefore of concern as environmental or public health contaminants. The products examined include: 3,4-dichloroaniline, aniline, 3-chloro-4-methylaniline, *m*-chloroaniline, *p*-chloroaniline, *p*-bromoaniline, 3-chloro-4-bromoaniline, and *m*-trifluoro-methylaniline. The lowest amounts easily quantifiable by the instrument discussed ranged from about 50 ng for aniline to about 400 ng for *m*-aminophenol. The new procedure is proposed for use with existing methodology for extraction and cleanup of amide, carbamate, and urea pesticides and their aniline metabolites. Methods are currently under study for the analysis of chloramben formulations and residues.

76-2850. Dmitriyev, L. B.; Yudina, L. P. (Timiryazev Agric. Acad., Moscow, USSR). **Gazokhromatograficheskiy metod opredeleniya kontsentratsii linurona v rastvore. [Gas chromatographic determination of linuron concentration in solution.]** *Izv. Timiryazev. Sel'skokhoz. Akad.* 2: 215-218; 1974. (4 references) (Russian)

Linuron was extracted from samples of sod-podzolic and chernozem soil previously treated with an aqueous solution of linuron. Linuron levels were determined by gas chromatography on the basis of its alkaline hydrolysis product, 3,4-dichloroaniline, using the chromatograph "Tsvet-5" with an electron capture detector particularly sensitive to halogen-containing compounds. Silicon SE-30 was used as the fixed phase, hexamethyldisiloxane as the solid support and N_2 as the carrier gas. The coefficient of sensitivity was 0.2 ± 0.004. The isotherms for linuron had an S-shaped curve indicative of biphasic adsorption. Humus had a high adsorptive capacity and is therefore significant in the adsorption of herbicides by soil. A linear adsorption isotherm of linuron in sod-podzolic soil without organic matter was obtained by gas chromatography and spectrophotometry.

76-2851. Storherr, R. W. (Registration Div., Environ. Protect. Ag., Washington, DC 20460). **Report on carbamate pesticides, fumigants, and miscellaneous.** *J. Assoc. Off. Anal. Chem.* 59(2): 338-340; 1976.

The proposed method for determination of carbanolate, carbaryl, carbofuran, and propoxur was recommended for official acceptance, and it was recommended that a collaborative study be initiated the silylation method for carbamate insecticides. Additional study is encouraged on the method for determination of cyanides in fatty foods and on determinations of fumigants in general. The gas chromatographic method for sodium monofluoroacetate may be examined for application to food samples.

76-2852. Burke, J. A. (Div. Chem. Phys., Food Drug Admin., Washington, DC 20204). **Report on chlorinated pesticides.** *J. Assoc. Off. Anal. Chem.* 59(2): 338-340; 1976.

The reports on ten Associate Referees are briefly presented on the topic of chlorinated pesticides. It was recommended that further work be performed on the nature and determination of chlordane residues. Specific reference was made to the terminal residues *cis*-chlordane, *trans*-chlordane, and octachlor epoxide as well as heptachlor epoxide in butter, poultry fat, and eggs. As regards chlorbenzilate, chloropropylate, and acarol, a procedure is being studied which will determine these residues as their trifluoroacetyl derivatives in order to achieve a limit of quantitation below 0.5 ppm. Studies on heptachlor and heptachlor epoxide indicate that discrete photoproducts can be formed in good yield from these chemicals, which may aid in identity confirmation. Studies are underway to determine hexachlorobenzene and mirex in butterfat and fish. A suitable method to determine Kelthane (dicofol) residues is under study. Significant progress has been made toward improving residues extraction from low moisture-high fat samples. It was recommended that available findings on chemicals tested through the AOAC multiresidues scheme be combined. Further studies have been conducted on the method used for determining organochlorine pesticides in fish in order to ensure that complete extraction of fat and organochlorine residues is obtained. An extension of current methods for determining polychlorinated biphenyls is presented. A collaborative study of the method combining the Florisil column chromatographic cleanup with acetonitrile extraction and GLC determination of tetradifon, endosulfan I, II, and sulfate, and tetrasul was recommended for adoption as official first action for determining such residues in apples and cucumbers. Studies to obtain reproducible and perhaps quantitative estimates from thin layer chromatographic analyses are underway. It is recommended that a collaborative study be started of the procedure for removal of DDT interference followed by GLC determination of toxaphene in conjunction with multiresidue methodology.

76-2853. Yip, G. (Div. Chem. Technol., FDA, Washington, DC 20204). **Report on fungicides, herbicides, and plant growth regulators.** *J. Assoc. Off. Anal. Chem.* 59(2): 340-341; 1976.

Based on the studies conducted in this field a number of recommendations were prepared. First, associate referees should be found for the topics of amiben, amitrole, benzimidazole fungicides, captan, and related fungicides, carbamate herbicides, dacthal, dichlobenil, dinitro compounds, diphenamid, dithiocarbamates, dyrene, 1-naphthaleneacetic acid, and naphthylacetamide, pic-

loram, sodium-*o*-phenylphenate, succinic acid, 2,2-dimethylhydrazide, and trifluralin. The topic of maleic hydrazide should be discontinued. Collaborative studies should be initiated on the topics of chlorophenoxy acids, dalapon, diquat and paraquat, and endothall. The collaborative study on ethylene thiourea should be completed. The official first action method for naphthaleneacetic acid, 29.139-29.143, should be adopted as official final action. The study on topics of dichloran, sodium trichloroacetate, substituted ureas, thiolcarbamate herbicides, and *s*-triazines should be continued.

76-2854. Corneliussen, P. E. (Div. Chem. Technol., Food Drug Admin., Washington, DC 20204). **Report on multiresidue methods (interlaboratory studies).** *J. Assoc. Off. Anal. Chem.* 59(2): 343-344; 1976.

Based on recent research conducted in this field certain recommendations are made. First, that the following callaborative studies be conducted: alakaline precolumn for the gas chromatographic determination of dichlorobis(phenyl)ethane derivatives; anodic stripping voltammetry and atomic absorption spectroscopy combined with dry ashing for the determination of cadmium, copper, lead, and zinc in selected foods; resin column chromatographic cleanup for determining multimetal residues; and determination of pesticides in meat and meat products. Eggs should be included in methods for all chlorinated compounds which are now covered in the Group I list of nonfatty foods. Kale should be included for all phosphated compounds now covered in the Group II list of nonfatty foods. The final recommendation is that *o,p'*-DDT be added to the list of compounds recovered from Group I nonfatty foods.

76-2855. McCully, K. A. (Health Protect. Br., Dep. Natl. Health Welfare, Ottawa, Ontario, Canada). **Report on phosphated pesticides.** *J. Assoc. Off. Anal. Chem.* 59(2): 345-349; 1976.

From reviewing work in this field, several recommendations were made. First, it was suggested that as associate referee be appointed to develop methodology for chlorine-containing organophosphorus pesticides. Secondly, it was suggested that presently available confirmation procedures be reviewed. A study should be conducted of the efficacy of gas chromatography (electrolytic conductivity) for the detection of nitrogen- and sulfur-containing organophosphorus pesticides. The general method in use for organophosphorus pesticides should be reviewed. Multiresidue methods should be developed for high fat samples. The scope of the carbon column cleanup method should be expanded. Continued study is needed to further develop and evaluate the gas-liquid chromatography method, including an extraction efficiency study and evaluation of the evaporation procedure. Multiresidue extraction and cleanup procedures should be examined for soils. Continued study is needed to automate and expand the scope of the official final action methods on sweep codistillation. Continued study is needed to evaluate cleanup and enzyme detection procedures as they are applied to quantitative thin layer chromatography. As associate referee should be appointed to study the development of multiresidue methods applicable to water.

76-2856. Ammann, B. D.; Call, D. J.; Draayer, H. A. (Dep. Chem., South Dakota State Univ., Brookings, SD 57006). **Gas-liquid chromatographic determination of alachlor (2-chloro-2',6'- diethyl-*N*-(methoxymethyl)-acetanilide) herbicide residues in corn and soybeans.** *J. Assoc. Off. Anal. Chem.* 59(4): 859-861; 1976.

A method has been developed for the extraction and determination of alachlor (2-chloro-2',6'-diethyl-*N*-(methoxymethyl)- acetanilide) residues in green corn and soybeans. Residues are extracted with acetonitrile and cleaned up on a Florisil column. The methylene chloride extract is sufficiently clean for electron capture gas-liquid chromatographic analysis and for verification by thin layer chromatography. Average recoveries of spiked samples (0.2 ppm) were 69 and 82% for corn and soybeans, respectively. This procedure could be useful for the detection of the parent compound in these crops soon after field application, but it does not detect metabolites. (Author abstract by permission)

76-2857. Coburn, J. A.; Chau, A. S. Y. (Water Qual. Br., Canada Cent. Inland Waters, Burlington, Ontario, Canada). **Gas-liquid chromatographic determination of 3-trifluoromethyl- 4-nitrophenol in natural waters.** *J. Assoc. Off. Anal. Chem.* 59(4): 862-865; 1976. (9 references)

A procedure for the analysis of 3-trifluoromethyl-4-nitrophenol (TFM) in natural waters is described. The lampricide is extracted from acidified water samples on the macroreticular resin XAD-7 and eluted from the column with ethyl ether. The ether extract is dried, concentrated, and partitioned with potassium carbonate. TFM is acetylated in the aqueous alkaline solution and the acetate derivative is extracted into benzene for analysis by electron capture gas-liquid chromatography. Recoveries of TFM from natural waters exceeded 90% and as little as 0.01 μg TFM can be quantitated in a 1 l sample. (Author abstract by permission)

76-2858. Kearney, P. C. (Agric. Environ. Qual. Inst., USDA, Beltsville, MD 20705). **IUPAC Commission on terminal pesticide residues.** *J. Assoc. Off. Anal. Chem.* 59(4): 866-893; 1976. (299 references)

The transactions of the eighth meeting of the IUPAC commission on terminal pesticide residues are reported. Organochlorine compounds studied included chlordane, aldrin, dieldrin, and toxaphene, with special attention to their metabolites, photodecomposition, the relation of endrin metabolism in mammals to its acute toxicity, and comparative metabolism studies in various species. Organophosphorus residues from diazinon,

cyanofenphos, and leptophos were evaluated in studies of plants, animals, and soil. Studies on carbamate residues from carbaryl, carbofuran, methomyl, aminocarb, mexacarb, and meobal included a study of nitrosocarbaryl which indicated that the environmental signficance of this metabolite should be viewed with some caution, as it is not formed under typical natural conditions. Fumigant residues studied included methyl bromide, ethylene oxide, and phosphine. Fungicide residues included the dithiocarbamates, particularly ethylenebisdithiocarbamate compounds, and the decomposition product ethylenethiourea. A dependable residue method is badly needed to detect ethylenethiourea in poultry and eggs. The herbicide residues study included reports on phenylamide-type pesticides in soil, with special attention to the formation of aniline-containing condensation products and chlormequat metabolism in wheat.

76-2859. Slade, P. (Plant Protect. Ltd., Fernhurst, Haslemere, Surrey, England). **IUPAC commission on the development, improvement, and standardization of methods of pesticide residue analysis.** *J. Assoc. Off. Anal. Chem.* 59(4): 894-910; 1976. (200 references)

Organochlorine residue studies included comparisons of multiresidue methods, extraction from soil and blood, rapid analysis of milk, cleanup absorbents, electrolytic conductivity detectors, and analysis of polychlorinated dioxins. Problems in using antimony pentachloride for PCB determinations were discussed. With organophosphorus compounds, multiresidue methods were not suitable for metabolite identification. Thin layer chromatography with enzymatic and/or chemical detection was better. For multiresidues of carbamates the fluorogenic labeling procedure combined with liquid chromatography was successful. A reliable analytical method for carbaryl is needed, and also a decision as to which residues should be measured. Analyses of hydroxyl-containing metabolites of carbamates are also needed. A direct GLC procedure has been developed for herbicidal carbamates using a Coulson conductivity detector. A multiresidue method was successfully completed for chlorinated hydrocarbon and other fumigant residues. For systemic fungicides a GLC method with a nitrogen detector was applied following derivative formation for ethirimol. With reference to dithiocarbamate fungicides it is recommended that a specific residue limit be set for ethylenethiourea in view of its constant occurrence following crop treatments with the dithiocarbamate fungicides and its toxicological significance. Recent advances in the analysis of rethrins and synergists are presented. Various selective gas chromatographic detectors are compared and the usefulness of each is discussed.

76-2860. Lawrence, J. F.; Sundaram, K. M. S. (Food Res. Div., Health Protect. Br., Health Welfare Can., Tunney's Pasture, Ottawa, Ontario, Canada). **Gas-liquid chromatographic analysis of *N*-(4-chlorophenyl- *N'*-2,6-difluorobenzoyl)urea insecticide after chemical derivatization.** *J. Assoc. Off. Anal. Chem.* 59(4): 938-941; 1976. (6 references)

The gas-liquid chromatographic analysis of TH 6040 (difluron, *N*-(4-chlorophenyl)- *N'*-(2,6-difluorobenzoyl)urea) was carried out after conversion to its *N,N'*-dimethyl analog (*N*-methyl-*N*- (4-chlorophenyl)-*N'*-methyl-*N'*- methyl-*N'*- (2,6-difluorobenzoyl) urea). The methylation was accomplished in DMSO with sodium hydride and methyl iodide. The derivative was thermally stable and chromatographed as a single peak on 3% OV-1 at 235°C. Support for the structure of the product was given by mass spectrometry. The sensitivity of the product to electrolytic conductivity detection was approximately 50 ng for 50% full-scale deflection in the nitrogen mode and 70 ng for the same response in the chloride (reductive) mode. About 0.25 ng was required for 50% full-scale deflection by electron capture (at nano- amp standing current). Foliage samples were analyzed for TH 6040, using the proposed method. (Author abstract by permission)

76-2861. Lawrence, J. F. (Food Res. Div., Bureau Chem. Safety, Food Directorate, Health Protect., Health Welfare Canada, Tunney's Pasture, Ottawa, Ontario, Canada). **Gas chromatographic separation of herbicides of major interest in Canada, with electrolytic conductivity detection in the nitrogen and chlorine modes.** *J. Chromatogr.* 121(1): 85-87; 1976. (1 reference)

The direct gas liquid chromatography separation of ten herbicides and two fungicides of major interest in Canada is reported. The use of the Coulson conductivity detector in the nitrogen and chlorine modes is compared. The chemicals used in these studies included: atrazine, benzoylprop-ethyl, chlorpropham, diallate, dichlobenil, dicloran, dyrene, EPTC, linuron, propanil, terbacil, and trifluralin. A Microtek MT220 was used. The columns were 1.3m × 6mm O.D. borosilicate glass. Liquid phases examined were 3% OV-1, 4% SE-30-6% SP-2401, 10% DC-200, and 5% DEGS, all coated on Chromosorb W HP (80-100 mesh). Column temperatures varied with the liquid phase used. The carrier gas (helium) flow rate was 60 ml/min. Operational parameters: injection port temperature 240°, transfer line temperature 230°, furnace temperature 820°, hydrogen 50 ml/min, d.c. voltage 30 V. The nitrogen mode was used for all chromatography retention times. The chloride mode was used with the 3% OV-1 column for determination of herbicide sensitivities. All parameters were kept the same as for the nitrogen mode, the only differences being the removal of the scrubber, use of a nickel wire catalyst and replacement of the strong anion-exchange resin with a mixed bed (H/OH) column.

76-2862. Lawrence, J. F. (Food Res. Div., Bur. Chem. Safety, Food Directorate, Health Protect. Br., Health Welfare Canada, Tunney's Pasture, Ottawa, Ontario, Canada). **Gas chromatographic analysis of heptafluorobutyryl derivatives of some carbamate insecticides.** *J.*

Chromatogr. 123(2): 287-292; 1976. (11 references)

The gas chromatography (GC) of a number of carbamate insecticides as their heptafluorobutyryl derivatives has been studied. The reaction makes use of heptafluorobutyric anhydride with trimethylamine in benzene as a catalyst. Conversion of the insecticides to their products is complete in 15-20 min at room temperature. The same reaction proved satisfactory for trifluoroacetylation. The excess reagent and trimethylamine are removed by partitioning with water in the reaction test tube. An aliquot of the organic phase is used for analysis. The heptafluorobutyryl derivatives are stable for several days on the lab bench without removal of the aqueous phase from the test tube. GC detection was carried out with a Coulson conductivity detector in the halogen (reductive) mode. About 1.0 ng produced a 50% full-scale response for most of the carbamates (3 min retention time) on 3% OV-1. This method was applied to the analysis of several carbamates spiked in corn, mustard greens, turnip greens, lettuce, and cabbage. (Author abstract by permission)

76-2863. Szalontai, G. (Anal. Dep., Neviki, 8201 Veszprem Pf 39, Hungary). **High-pressure liquid chromatography of organophosphorus insecticides.** *J. Chromatogr.* 124(1): 9-16; 1976. (6 references)

The high-performance liquid chromatographic (HPLC) behavior of 23 organophosphorus insecticides was studied using a stainless-steel column packed with silica gel. Testing showed that HPLC was a suitable method for separating and measuring the insecticides. In the case of vinyl phosphate isomers this method had certain advantages over the gas chromatographic method. The compounds were divided into four structural classifications: phosphonic acid esters, phosphoric acid esters, thiophosphoric acid esters, and dithiophosphoric acid esters. The classification of the compounds gave some information about the adsorption properties of the molecules. Of the 10 phosphorus acid esters, 8 were successfully analyzed by varying the ethanol content of the eluant between 3 and 10% and the flow rate from 0.55 to 1.16 ml/min. Crufomate and dichlorvos had adsorption properties greatly different from those of the other compounds, perhaps due to the absence of a carbaryl group which would be able to form hydrogen bonds. The thio- and dithiophosphoric acids had similar adsorption properties. With the exception of dimethoate, they were successfully analyzed by varying the *n*-propanol content between 0.25 and 2% and the flow rate from 0.53 to 1.75 ml/min. With dimethoate, the relatively strong adsorption of the molecule is caused by the -CO-NH- functional group.

76-2864. Arjmand, M; Mumma, R. O. (Pesticide Res. Lab., Pennsylvania State Univ., University Park, PA 16802). **Metabolism of 2,4-dichlorophenoxyacetic acid. IX. Gas-liquid chromatography of methyl esters of amino acid conjugates.** *J. Chromatogr.* 124(1): 97-104; 1976. (15 references)

The GLC separation of the methyl esters of 2,4-D, its hydroxylated metabolites, and thirteen amino acid conjugates of 2,4-D is reported. GLC separation of the methyl esters of the amino acid conjugates of 2,4-D and other hydroxylated metabolites of 2,4-D was achieved on 1% OV-17 (80-100 mesh Supelcoport). Twelve of the 16 methyl esters and 8 amino acid conjugates, Ala, Val, Leu, Ile, Glu, Met, Phe, and Trp, were completely separated in 26 min. The separation achieved on 1% OV-17 would be sufficient to analyze for all of the identified 2,4-D metabolites. GLC separation achieved on 2% OV-1 (100-120 mesh Supelcoport) separated 10 methyl ester derivatives completely and five partially. All derivatives analyzed gave a linear response with the flame ionization detector over a range of 2-10 μg and are suitable for quantification using an internal standard.

76-2865. Das, K. G.; Thayumanavan, B. (Natl. Chem. Lab., Poona, India 411008). **Screening methods to identify in foods some common pesticides used in India.** *J. Sci. Ind. Res.* 34(11): 636-641; 1975. (45 references)

Methods currently employed for the identification and estimation of some common pesticides used in India are reviewed. Specific details are given for the extraction of organochlorine and organophosphorus pesticides, organomercuric fungicides, methyl bromide and ethylene dibromide, thiram and ziram, and zineb. Paper chromatography and thin layer chromatography are the most useful techniques for the identification of pesticide residues. Each is discussed in some detail. Liquid-liquid partitioning, adsorption chromatography, sweep co-distillation methods, and gel permeation chromatography are used in clean-up procedures. Most of the screening methods for pesticide residue analysis rely primarily on some type of chromatography for the determinative step. Some other useful techniques are spectrophotometry, polarography, fluorimetry, bioassay, and radiochemical methods. The gas chromatographic method is detailed in this paper. The use of a method other than that use for the initial determination is stressed for confirmation techniques.

76-2866. Kuteev, F. S.; Zharkikh, M. D. (All-Union Sci. Res. Inst. of Forestry and Forestry Mechanization, USSR). **Primenenie kolorimetricheskikh metodov dlya opredeleniya khlorofosa, benzofosfata i metilnitrofosa v ob''ektakh lesnogo biotsenoza. [Use of colorimetric methods for determining chlorophos, benzophosphate, and methylnitrophos in objects of a forest biocenosis.]** *Khim. Sel'sk. Khoz.* 12(7): 50-52; 1974. (3 references) (Russian)

Colorimetric methods for the determination of trichlorfon, benzophosphate, and fenithion in objects of sylvan biocenoses, and analyses of grass, leaves, soil, and water for the above pesticides are described by these methods. After extraction with sulfated ether and distilled water, trichlorfon was determined with pyridine after sulfuric acid and potassium dichromate were added. Investigation of grass and oak leaves from a forest area

treated with trichlorfon at a rate of 1.3 kg/ha from aircraft revealed that the decomposition of this pesticide begins during the first days. Similar investigations showed that 60% of benzophosphate are decomposed in oak leaves, grass, and soil in two weeks after application. Benzophosphate was determined by measuring the optical density of the copper complex of diethyldithiophosphoric acid, the hydrolysis product of this compound. Methylnitrophos was determined by incubating plant samples with acetylcholinesterase. Oak leaves and grass contained no residues of methylnitrophos two weeks after spraying.

76-2867. Usmentseva, A. Z.; Piontkovskaya, M. A.; Klisenko, M. A.; Tret'yak, M. G. (All-Union Sci. Res. Inst. Sugar Ind., USSR). **Khromatograficheskiy metod ochistki ekstraktov melassy i zhoma, soderzhashchikh fosfamid ili khlorofos. [Chromatographic purification of molasses and beet pulp extracts containing phosphamide or chlorophos.]** *Khim. Sel'sk. Khoz.* 13(6): 62-63; 1975. (5 references) (Russian)

The suitability was studied of different adsorbents for the column chromatographic purification of benzene, acetone, and chloroform extracts of phosphamide (dimethoate) and trichlorfon from molasses and beet pulp. The pesticides were subsequently eluted from the adsorbents with acetone or chloroform. A hexane-acetone mixture at a 1:1 ratio (phosphamide) or a 3:2 mixture of benzene and acetone (trichlorfon) were used as solvent systems for the final thin-layer chromatographic determination. The experiments demonstrated that silica gel, activiated carbon, and alumina are unsuitable, while magnesil and florisil are suitable for the clean-up of molasses and beet pulp extracts of phosphamide and trichlorfon. The recovery rate was 85-100%.

76-2868. Gromiec, J. (Inst. Med. Prac. Przem. Wlokien. Chem., Lodz, Poland). **Oznaczanie pieciochlorofenolu i jego estrow w powietrzu. [Determination of pentachlorophenol and its esters in air.]** *Med. Prac.* 27(2): 127-134; 1976. (8 references) (Polish)

A method is presented for determining pentachlorophenol fatty acid ester concentrations in air. The air to be sampled is passed through a glass filter and esters are extracted from the filter with ether. The ether extract is placed into an evaporator and, after the solvent is removed, the dry residue is treated with a mixture of concentrated sulfuric acid and potassium bichromate. The decomposition of the PCP esters results in free chlorine release. The amount of chlorine released is determined with methyl orange. This method is non-specific. In the presence of pentachlorophenol in air, the sum of PCP and its esters is determined. A specific method for the determination of PCP in the presence of its esters is elaborated. PCP reacts with safranine O in alkaline solution, forming a pink complexon compound which is extracted with chloroform and measured spectrophotometrically. The PCP ester concentration is calculated from the difference in the above two concentrations. This method allows the determination of the concentration of any PCP ester or the sum of a mixture of esters, but the identification or separation of individual esters is not possible. The limit of determination is 0.033 mg/m^3 of air for both PCP and its esters.

76-2869. Tewari, S. N.; Harpalani, S. P.; Tripathi, S. S. (Toxicol. Sect., Lab. Chem. Exam. Gov. Serol., Uttar Pradesh, Agra, India). **Determination of thallium in autopsy tissues and body fluids by spectrophotometric technique.** *Mikrochim. Acta* 1: 13-18; 1975. (14 references)

A sensitive and specific spectrophotometric technique is described for the determination of microgram amounts of thallium in autopsy tissues and body fluids. In this work optimum conditions were found for producing stable thallium dithizonate free from other interfering metals. The material is subjected to wet combustion, extraction of thallium as thallic chloride with ether, and finally the formation of thallium(I) dithizonate. In comparing the amounts of thallium determined in different tissue samples and in urine from an autopsy study, a relatively high amount of thallium was noted in the brain. This suggests preferential deposition in the brain tissue.

76-2870. Watkins, D. A. M. (Long Ashton Res. Stn., Univ. Bristol, Long Ashton, Bristol BS18 9AF, England). **Benzimidazole pesticides: analysis and transformations.** *Pestic. Sci.* 7(2): 184-192; 1976. (60 references)

Properties, analysis, and transformation by plants, animals, soil, and light are reviewed for benomyl, carbendazim, thiabendazole, fuberidazole, cypendazole, and fenazaflor. The formation of carbendazim from benomyl results from a nucleophilic attack by water on the butylcarbamoyl group. The elimination of a proton from a second water molecule allows the subsequent formation of carbendazim. The solubility of benomyl and carbendazim in most common organic solvents is very limited, although carbendazim is readily soluble in acid. The highest solubility in organic solvents seems to occur in dimethyl sulfoxide. The quantitative determination of benomyl, carbendazim, and 2-aminobenzimidazole, either separately or together, is not straight-forward. Studies are reviewed of the relative amounts of benomyl and carbendazim remaining in and on various plants over a period of time. Studies on the fate of benomyl in soil have shown that the major portion of benzimidazole-containing residues remain in the top 100 mm and have a half-life of 3-6 months in turf and 6-12 months in bare soil. Studies on benomyl metabolism in rats, dogs, cows, and chickens show cleavage of the butylcarbamoyl group and then hydroxylation occur, with the formation of methyl 5-hydroxybenzimidazol- 2-ylcarbamate as the major product and small amounts of a 4-hydroxy compound. Transformation of thiophanate-methyl to carbendazim by UV light has been reported. Thiabendazole, used as a postharvest fungicide on citrus fruit and bananas, is a stable compound whose residue analysis is not as difficult as that

of benomyl. Its metabolism in man and animals shows the formation of 5-hydroxythiabendazole. The rate of its disappearance from pepper leaves was 3 to 4 times faster than that of carbendazim. Cypendazole is hydrolyzed under strong alkaline and strong acid conditions. Fuberidazole, used for treating seeds particularly against *Fusarium* spp., has been shown to metabolize in animals to yield a 5-hydroxy compound and various conjugates as well as compounds formed by the degradation of the furan ring. Fenazaflor, a non-systemic acaricide with considerable residual activity, yields three different hydroxy compounds in animal, insect, and plant metabolism

76-2871. Vorster, J. D. M.; Hasty, R. A.⅓ (Dep. Chem., Univ. Witwatersrand, Johannesburg 2001, South Africa). **Field assay of the pesticide 2-chloro-1- [2,4-dichlorophenyl] vinyldiethylphosphate.** *S. Afr. J. Sci.* 72: 90-91; 1976. (12 references)

A procedure is presented for field assay of chlorfenvinphos, 2-chloro-1-[2,4-dichlorophenyl] vinyldiethylphosphate. A series of 20 ml aqueous aliquots containing between 0 and 0.5 g/l of the pesticide were hydrolyzed by the addition of 8 g of sodium hydroxide to each of the samples. After 15 min the solutions were extracted by three chloroform portions of 5, 2, and 2 ml. These extracts were combined and diluted to 10 ml and the absorbance measured at 455 nm. The absorbances ranged from 0 to 0.5 and were proportional to the compound's concentration from 0.1 to 0.5 g/l. This procedure, although not a general one for organophosphorus compounds, is suitable for the estimation of 2-chloro-1- [2,4-dichlorophenyl] vinyldiethylphosphate. The procedure is simple so that highly skilled technicians are not required.

76-2872. Usmentseva, A. Z.; Zagorul'ko, A. Ya.; Klisenko, M. A. (All-Union Sci. Res. Inst. Sugar Ind., USSR). **Opredelenie ostatochnogo kolichestva nekotorykh fosfororganicheskikh pestitsidov v sakhare. [Determination of residual amounts of certain organophosphorus pesticides in sugar.]** *Sakh. Prom'st.* 5: 52-55; 1975. (4 references) (Russian)

A thin-layer chromatographic method is described for the determination of residues of trichlorfon, metaphos (methyl parathion), thiophos (parathion), and trichlorometaphos-3 in beet sugar. Following extraction with chloroform (for trichlorfon and trichlorometaphos-3) or *n*-hexane (for the other pesticides) the extract is cleaned up on an ion exchange resin-packed column to remove pigments and other impurities, after which the residues are eluted with acetone or chloroform. An alumina plate is used for trichlorometaphos-3, and silica gel for the other pesticides. The mobile phase is hexane-acetone or *n*-hexane-acetone at different ratios from 1:1 to 1:4. Trichlorfon (*R*f 0.33) appears in the form of pink spots after development with 2% resorcinol and 10% sodium carbonate in a 2:3 ratio. Metaphos and thiophos are developed with 0.25% *n*-dimethylaminobenzaldehyde and glacial acetic acid in alcohol at a 10:1 ratio to obtain bright yellow spots (*R*f 0.43). Trichlorometaphos-3 appears in the form of black spots after development with silver nitrate in an ammonia-acetone mixture.

76-2873. Usmentseva, A. Z.; Kiseleva, N. I.; Klisenko, M. A.; Zagorul'ko, A. Ya. (All-Union Sci. Res. Inst. Sugar Ind., USSR). **Khromatograficheskiy metod opredeleniya mikrokolichestv polikhlorpinena v sakhare. [Chromatographic method for determining traces of polychloropinene in sugar.]** *Sakh. Prom'st.* 4: 51-54; 1976. (5 references) (Russian)

A thin-layer chromatographic method is described for the determination of trace quantities of polychloropinene (strobane) in beet sugar. After extraction from aqueous solution with *n*-hexane, the extract is purified by means of concentrated sulfuric acid or on a column packed with a paste of alumina in concentrated sulfuric acid. After neutralization with distilled water, the sample is dried with anhydrous sodium sulfate. The residue is taken up in *n*-hexane. In the absence of DDT and other organochlorine pesticides, polychloropinene is determined by a macrochromatographic method, using KSK silica gel with a grain size of 40-60 microns, a 6:1 mixture of *n*-hexane and ethyl acetate as solvent, and an ammoniacal-acetone solution of silver nitrate for development; or by a microchromatographic method, using KSK silica gel with a grain size of 3-5 nm, a 10:4:0.3 ratio mixture of *n*-hexane, methanol, and ammonia as solvent, and the same developer as in the former method. Polychloropinene appears in the form of grayish black spots. In the presence of DDT and other organochlorine pesticides, the color reaction of these substances with aromatic amines is utilized. The developing reagent is a 0.5% solution of diphenylamine and a 0.5% solution of zinc chloride in acetone. The plates are heated at 140-150°C for 15 minutes. Following this treatment DDT and DDE appear as red spots, heptachlor as light blue spots, and DDD as dark blue spots, while polychloropinene appears as bluish green spots. The rate of recovery for polychloropinene is 90 ± 5.1%. The sensitivity of the method amounts to 0.5-1.0 μg, corresponding to 0.01-0.02 mg/kg.

76-2874. Serko, S. A.; Potapenko, M. I.; Kozhemyakin, N. G. (Dep. Vet. Hyg., Leningrad Inst. Vet. Sci., Leningrad, USSR). **K voprosu opredeleniya khlorofosa v moloke. [Determination of chlorophos in milk.]** *Sb. Rab. Leningr. Vet. Inst.* 36: 64-67; 1974. (9 references) (Russian)

An improved thin-layer chromatographic method is described for the determination of chlorophos (trichlorfon) in milk. Following centrifugation at 5,000 rpm and filtration through filter paper, extraction is done with chloroform. The concentrated sample is applied to a KSK silica gel plate. To remove traces of fat from the spot, the plate is treated with a 1:1 mixture of benzene and hexane. The dried plates are then treated with a 9:1 mixture of

chloroform and diethyl ether. Development is done by consecutive spraying with a 10% alcoholic solution of potassium hydroxide and a 1% aqueous solution of resorcinol. Trichlorfon appears on the plate in the form of raspberry-colored spots. Quantitative determination is done according to E. S. Kosmatyy's method. At a lower limit of detectability of 5-10 μg, corresponding to 0.1 mg/liter, the accuracy of the method is 90-95%.

76-2875. Girenko, D. B.; Klisenko, M. A. (All-Union Sci. Res. Inst. Hyg. Toxicol. Pestic., Polymers, and Plastics, Kiev, USSR). **Korrelyatsionnaya zavisimost' mezhdu velichinoy signala detektora i stroeniem proizvodnykh galoisoderzhashchikh aromaticheskikh uglevodorodov.** [**Correlation dependence between the value of the detector signal and the structure of derivatives of halide-containing aromatic hydrocarbons.**] *Ukr. Khim. Zh. (Russ. Ed.)* 41(4): 422-425; 1975. (10 references) (Russian)

Correlations between the electron capture detector signal and the structure of halide-containing aromatic hydrocarbons were studied with respect to tedion (tetradifon), efirsulfonate (ovex), *p,p'*-DDE, *p,p'*-DDD (TDE), *p,p'*-DDT, *o,p'*-DDT, methoxychlor, milbex, kelthane, perthane, dicryl, stam-F-34, linuron, diuron, patoran, monolinuron, monuron, solan, and tenoran. The detector signal was lower for compounds with saturated carbon atoms (DDD, DDT, methoxychlor) than for substances with double bonds in their molecule. The substitution of the central carbon atom by a highly electronegative group (SO_2) caused a considerable increase in the relative sensitivity, as in the case of tedion and efirsulfonate. A reduction of the electronegative character of the substituents in the phenyl ring, e.g., in the presence of methoxy group, caused a drop in the detector signal. The same effect was also observed in the presence of an alkyl radical. Halogen atoms in *para* position in the ring, groups analogous with the carbonyl group, and unsaturated double bonds made major contributions to the detector signal. The findings indicate that the level of the detector signal is determined by the electronegativity of the atoms and groups present in the molecule, and that the relative sensitivity value can sometimes be used for the additional identification of trace quantities of such compounds.

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